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AUGUST, 1953

# APPLIED HYDRAULICS

THE MAGAZINE OF FLUID POWER TRANSMISSION

INCLUDING AIR CONTROLS AND AIR CIRCUIT DESIGN; ELECTRICAL CONTROLS


CONTROL CIRCUITS . . . . . Pg 47

POWER CIRCUIT FOR WAX INJECTION MACHINE . . . . . Pg 51

OIL TEMPERATURE CONTROL . . . . . Pg 53

CYLINDRICAL PISTON ACCUMULATORS . . Pg 58

AIR-OIL BOOSTER CIRCUIT . . . . . Pg 61

DEVELOPMENT OF "O" RINGS . . . . . Pg 82


*This National Magazine Comes To You With The Compliments Of*

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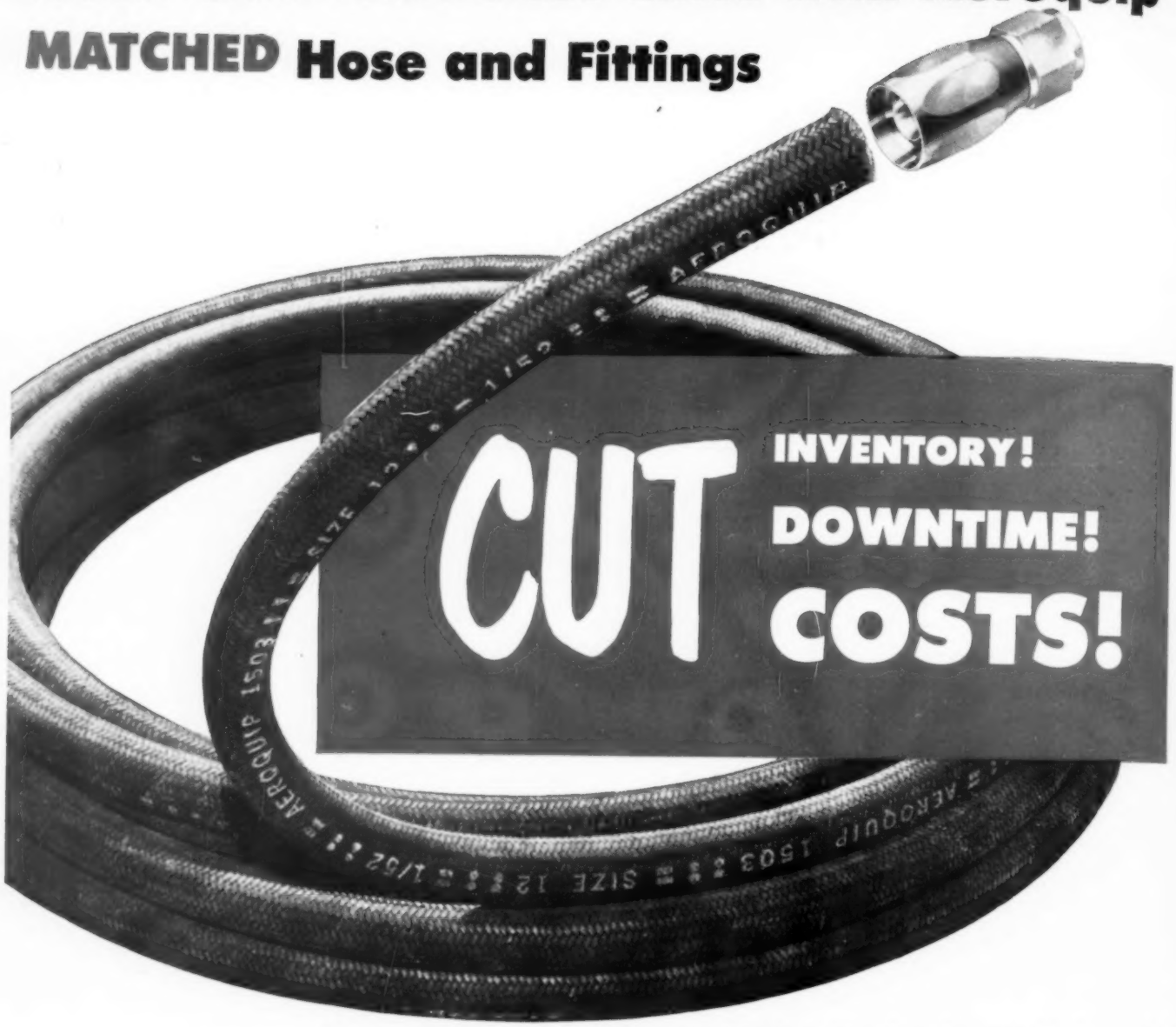
# Make Your Own Hose Lines with Aeroquip MATCHED Hose and Fittings




**Aeroquip Fittings are designed, developed, and produced to go with Aeroquip Hose. They form such a foolproof combination that Aeroquip *guarantees* performance. Thus, the hose lines made right in your own plant always measure up to Aeroquip's exacting standards of quality, the highest in the industry. A small supply of Aeroquip Bulk Hose and Fittings assures you of quick hose line replacements at all times . . . and Aeroquip Fittings are detachable and may be used again and again when making new hose assemblies.**

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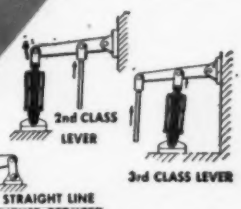
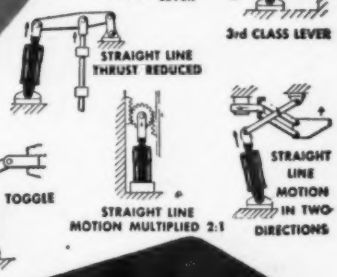
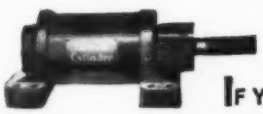
Circle 4 on Reader Service Card

# ...how can I use HANNA® cylinder power in my machine tools and equipment?



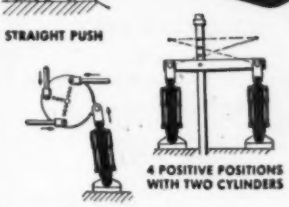




## here are basic Cylinder Powered MECHANICAL MOVEMENTS that can be put to work for YOU!



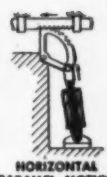
IF YOU HAVE a push, pull, lift, press, clamp or control problem, Hanna Cylinder Power can be the answer. The mechanical movements here illustrated may suggest ways Hanna Cylinders can be used to simplify the actuation and control of machines or equipment and to replace or reduce manual effort.

In the majority of cases, you can select a standard cylinder model to meet your specific requirements from the broad Hanna Hydraulic and Pneumatic lines. Regardless of whether you choose a "standard" or "special" the Hanna label assures you of quality developed through fifty years of concentration on cylinders and their control valves!









**SEND FOR FREE BULLETIN 255**

"Cylinder Power in Action" is described in new Bulletin 255. *Write for it today.*

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HYDRAULIC AND PNEUMATIC EQUIPMENT . . . CYLINDERS . . . VALVES . . . RIVETERS

AUGUST, 1953
Vol. 6. No. 8

# APPLIED HYDRAULICS

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## CONTENTS

CONTROL CIRCUITS for Feed-Clamp-Work Cycle ..... 47
By Ralph L. Hankin

SMALL POWER INPUT Develops 35 Tons in Manually Operated Machine ..... 51

OIL TEMPERATURE CONTROL on 1000 Ton Rubber Curing Presses ..... 53
By R. L. Guggenheim

AIR POWER Handles Biggest Mixer ..... 56

THE DEVELOPMENT of Cylindrical Piston Accumulators ..... 58
By John W. Overbeke

SPECIAL PRESS Has Simple Air-Oil Booster Circuit ..... 61

BEGINNER'S COURSE IN BASIC PNEUMATICS
Section III, Part 2, Air Cylinders ..... 66

NATIONAL CONFERENCE ON INDUSTRIAL HYDRAULICS ..... 72

CYLINDERS Move 2500 lb. Coils ..... 104

## AVIATION SECTION

Development of "O" Rings for Aircraft Applications ..... 82
By Frank R. Straus

## DEPARTMENTS

FLUID POWER LINES ..... 7

LITERATURE OFFERED IN THIS MONTH'S ADS ..... 8

NEW COMPONENTS ..... 19

TRENDS ..... 24

LETTERS TO THE EDITOR ..... 26

USEFUL LITERATURE ..... 64

POSTSCRIPTS OF INDUSTRY ..... 118

MARKET PLACE ..... 126

ADVERTISERS' INDEX ..... 127, 128

Published monthly, by THE HYDRAULICS PUBLISHING CO. an affiliate of INDUSTRIAL PUBLISHING CO., publishers of COMMERCIAL REFRIGERATION & AIR CONDITIONING, PRECISON METAL MOLDING, FLOW, INDUSTRY & WELDING, and OCCUPATIONAL HAZARDS. Member, Controlled Circulation Audit, Inc.

Subscription rates: United States and possessions—$3.00 per year, $5.00 for 2 years; Canada—$4.00 per year, $6.00 for 2 years; Foreign—$5.00 per year, except the United Kingdom. United Kingdom subscriptions £1.10 per year, payable in Sterling to our London Office. Single copy price, 30 cents. All subscriptions subject to individual acceptance by the publisher.

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*U.S. Army Photograph*

# Quick on the bull's-eye and stay there

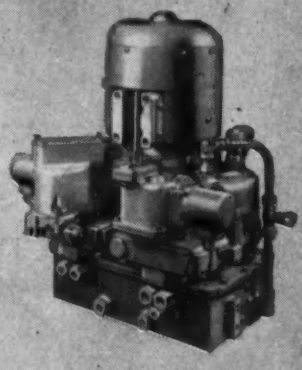
## WITH OILGEAR FLUID POWER

**Meeting speed, control and precise performance requirements of today's U. S. Tanks, Howitzers and Anti-Aircraft Guns is a "Natural" for Oilgear ANY-SPEED Fluid Power Components.**

Gunners in Sherman, Pershing and Patton tanks experienced the advantages of rapid fluid power slewing and precise fluid power tracking of the turret and gun 360° in either direction. They appreciated the value of Oilgear fluid power that obeyed a light twist of the wrist. Likewise, those manning America's most effective 40 mm anti-aircraft guns, recognized the importance of automatic, self-synchronizing Oilgear fluid power drives for rapid slewing and precise tracking of the carriage 360° in either direction and the rapid, accurate elevating and depressing of the gun for quick homing on the target and following it.

Therefore, when today's new combat vehicles with far greater fire power and accuracy were planned, Oilgear ANY-SPEED Fluid Power Drives were a "Natural" for both turret traverse and gun elevation. They met the demands for accurate control over speed ranges up to 4000:1. They provided unbelievably low tracking speeds under precise response without overrun or drift. They stayed on the target for repetitive shots. No wonder, one men's magazine calls the new Oilgear equipped M47 "the sharpest shooting tank anywhere today." That's why Oilgear ANY-SPEED fluid power drives are a "Natural" on the wide variety of U. S. combat vehicles.

Don't you think it is time for you to look with wide open eyes at Oilgear Fluid Power Pumps, Motors and Transmissions for your machines... to better the performance of an already good machine? To solve a seemingly "impossible" design problem? To synchronize machine units easily and economically? To weed out trouble and cut maintenance and down time to a surprisingly low level? Counsel with an Oilgear Engineering Representative will cost you nothing, may benefit you greatly. THE OILGEAR COMPANY, 1564 W. Pierce St., Milwaukee 4, Wisconsin.



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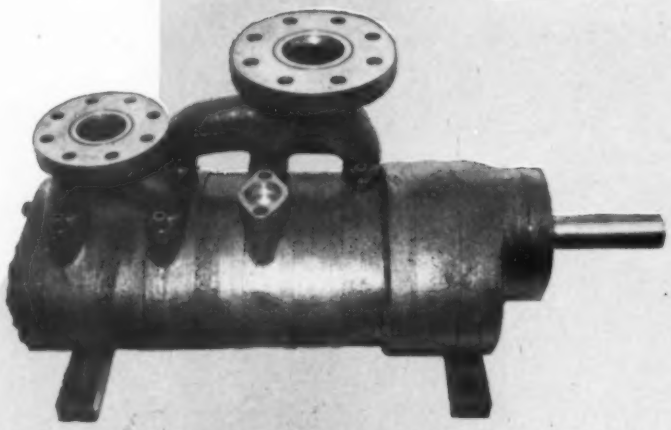
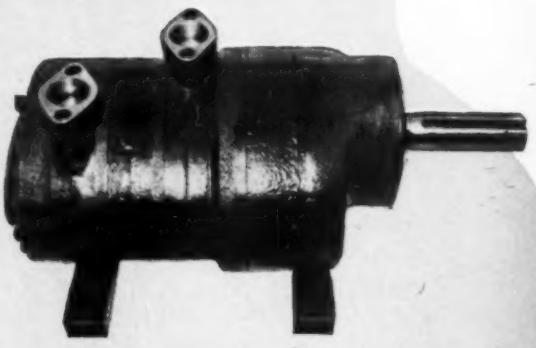
# Now—a BERRY *Rotodraulic* (TRADE MARK) unit

## New, rugged 32-10 series pumps and motors have

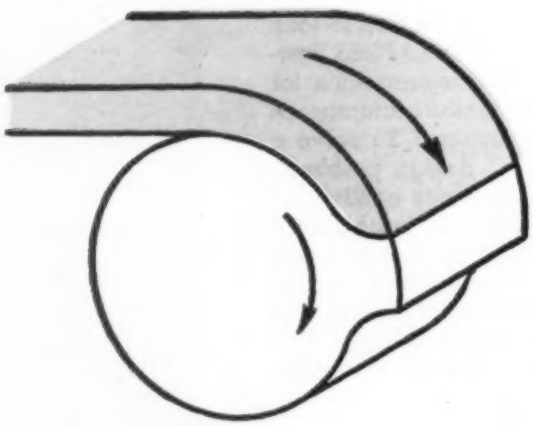


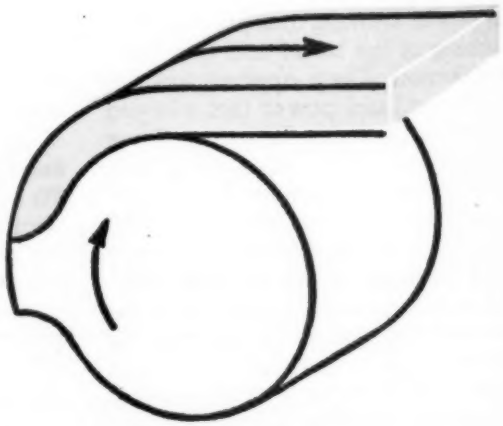
Unit shown above, Model 32-10 E3, is rated for 1000 psi continuous service. As pump, displacement is 180 GPM at 1200 RPM. As fluid motor, unit is rated up to 300 horsepower at 2800 RPM.



Model 32-10 D1 above displaces 60 GPM at 475 RPM as a pump. It is designed for 1000 psi continuous duty. Intermittent service up to 1500 psi is permissible. As a fluid motor, this unit is rated up to 100 horsepower at 1087 RPM, and 6300 lb. ins. of torque.

Multi-cylinder Berry units offer the advantages of common suctions and separate discharges. Each cylinder thus can discharge to different services and different pressure. The 32-10 E3 shown here has a common suction manifold with two cylinders discharging to one line and one cylinder discharging alone.





**Motors** Positive torque at all speeds down to zero is assured by the force of the liquid column under pressure acting on the torque arm of the rotary piston.

**Pumps** Positive displacement of the oil is assured as the unique Berry rotating piston sweeps its cylinder arc in every revolution — ***pushing*** the liquid column before it at the pressure required.

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## unlimited applications, capacities up to 300 h.p.

Now ready to take on your heaviest assignment is the same revolutionary Berry rotating piston that has proved so successful in many industrial and petroleum field jobs.

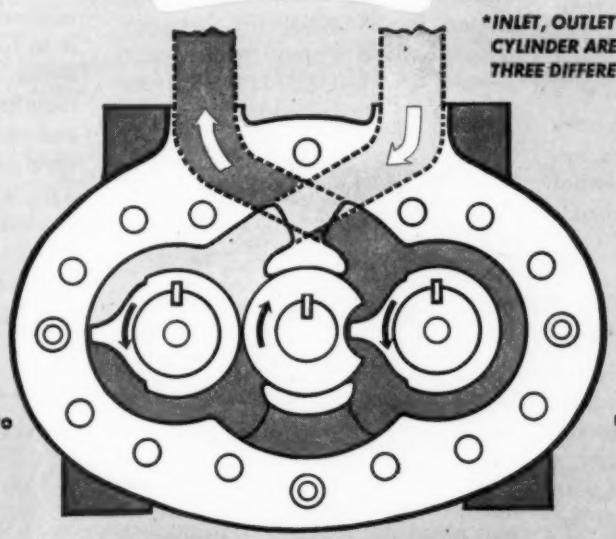
Industrial applications include saw-mills, machine tools, liquid fuel transports, draw-benches, drop forges, harvesting machines, extrusion presses, metal-working machines and many more.

In the oil fields, Berry units are powering vibrating screens, water pumps, mud mixers, wire measuring reels, bug blowers, pipe-wrapping machines and shot-hole drilling rigs.

Interchangeable as pumps or fluid motors and designed for overhung loads, Berry units are rugged, shock resistant, dependable, positive, economical, long-lived. Write us for full details or call your local distributor.

***A few suggested uses for Berry 32-10 Units:***

**• Steam Shovel Conversions • Winches • Hoists • Drag Lines • Earth-Moving Equipment • Drilling Rig Rotary Tables • Mining Machinery • Steel Mill Machinery • Large Saw Mills.**




***Pressures:***
**to 1000 psi continuous**
**to 1500 psi intermittent**

***Speeds:***
**motors — 2800 RPM down to zero**
**pumps — up to 1200 RPM**

***Ratings:***
**to 300 horsepower**

***Displacements:***
**motors — 138, 276, 414 GPM**
**pumps — 60, 120, 180 GPM**

***Torques*** **— to 21,000 lb. ins.**

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| | |
|---|---|
| Positive Torque | Positive Displacement |
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| Variable Speed | Instantaneous Reversibility |
| Long Life | Rugged Dependability |
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| Series and Parallel Operation | Motor-Pump Interchangeability |

# BERRY DIVISION

ROTARY POWER

**Oliver Iron and Steel Corporation, Pittsburgh 3, Pa.**



Circle 14 on Reader Service Card

# Fluid Power Lines

## Hot Spots

We recently talked with the engineers at Kewanee-Ross Corporation about the problem of selecting oil coolers for hydraulic systems. We learned that while each installation has its own unique requirements which must be analyzed, there are similarities between all hydraulic systems, you can get good ideas by studying other completed, successful installations.

One circuit, requiring temperature regulation is discussed in this issue by Bob Guggenheim of Adamson United Company, who has applied several ideas for the regulation of oil temperature on rubber curing presses.

## Customer Preference

We almost always find ourselves asking: "Why did you select this design in preference to that design?", when we are discussing a design story with its author. Where there are several approaches to the same job and each has specific engineering merits and drawbacks which tend to balance each other, the choice often depends on customer preference. A designer, without knowledge of what the customer wants and is willing to pay for, is like a car without an engine—it ain't goin' nowheres.

Design of the cutoff machine which is detailed by Ralph Hankin in this issue includes hydraulic power for feeding and clamping. Because the spindle drive must be driven at variable speeds, we asked if a hydraulic transmission had been considered to drive the spindle in place of the AC-DC drive presently being used. The machine is readily adaptable to hydraulic drive in ranges from 5 to 20 horsepower. However, customer preference has been for electric drives. What's the reason for this? It appears that one of the most important reasons is that many shops lack a general knowledge and experience with hydraulic drives.

So, while the design engineer must be made aware of customer preference, the management, sales and service engineers have the important job of influencing that preference so that designs having engineering and production advantages will not be shoved aside.

## Bait for Fishing

We're not guilty of always talking about hydraulics and pneumatics and to avoid going completely berserk on the subject we like to use this page to inject some unrelated words. So during lunch hours we scout for helpful ideas for your and our off-hours. During a recent lunch, in North Chicago with Dan Kresbach of Walter Norris Engineering and Harold Carsley of Cyclone Fence we picked up a method for catching fresh crickets for fishing bait.

It's Harold Carsley's fool-proof method. Get a loaf of bread . . . cut it in half . . . scoop out the soft innerds . . . scotch tape the halves together . . . poke a hole in one end and then leave it in the back yard over night. If it's still there at five a.m. when you sneak out with rod in hand, Harold guarantees that it'll be loaded with crickets.

Hope you can use the idea. We never get up that early.

---

## Piston Accumulators

In the last 10 years, the development of hydropneumatic accumulators has been rapidly progressing as more applications for the power generators are being made. The development has included the design of the diaphragm and bag type units and more recently the "O" ring sealed piston construction.

John Overbeke's article "Development of the Cylindrical Piston Accumulator" details the design of a recently introduced double wall piston accumulator. Mr. Overbeke, (Case Institute of Technology, M.E., 1925), has an outstanding record as a design and consulting engineer in both aircraft and industrial hydraulics. Associated with Glenn L. Martin, Great Lakes Aircraft and Simmonds Aerocessories, with the latter as chief engineer.

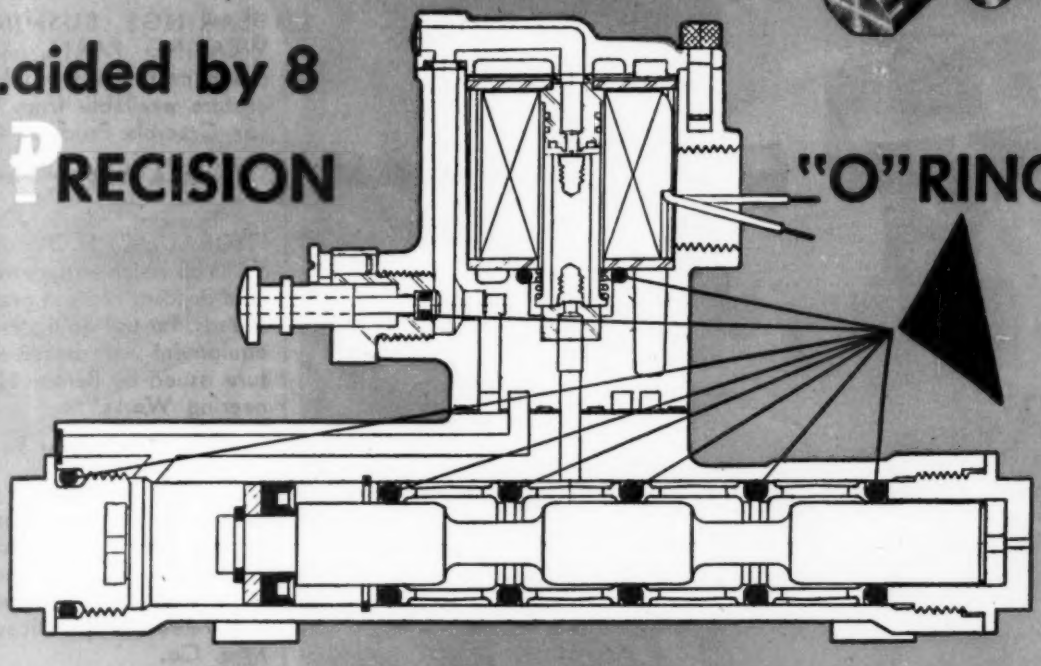
*John W. Overbeke*

Overbeke was a consulting engineer for four years till he joined The Parker Appliance Co. as special developments staff engineer in 1948. In 1951 he became chief engineer, Superior Hydraulics Division, Superior Pipe Specialties Co. where he is responsible for the design of both aircraft and industrial, piston type, hydraulic accumulators.

---

# 55 million cycles and this 4-way valve is still going strong!

..aided by 8 PRECISION "O" RINGS



This pilot-operated 4-way valve—developed by THE VALVAIR CORPORATION of Akron, Ohio—employs *8 Precision* "O" Rings for leak-proof sealing under air, oil, water or inert gas pressure. Designed to give trouble-free performance for more than 50 million cycles of heavy-duty service, this compact valve requires "O" Rings of *highest quality*—and that is why *Precision* "O" Rings were chosen!

Everyone is finding *Precision* "O" Rings the best answer to many sealing problems—and they are finding, too, that *Precision* leads the field in engineering help and proper deliveries to keep production lines going. Let us work with you. Send for our "O" Ring Handbook and let us have your inquiries.

*FREE—Write for your personal copy of our new Handbook on "O" Rings.*

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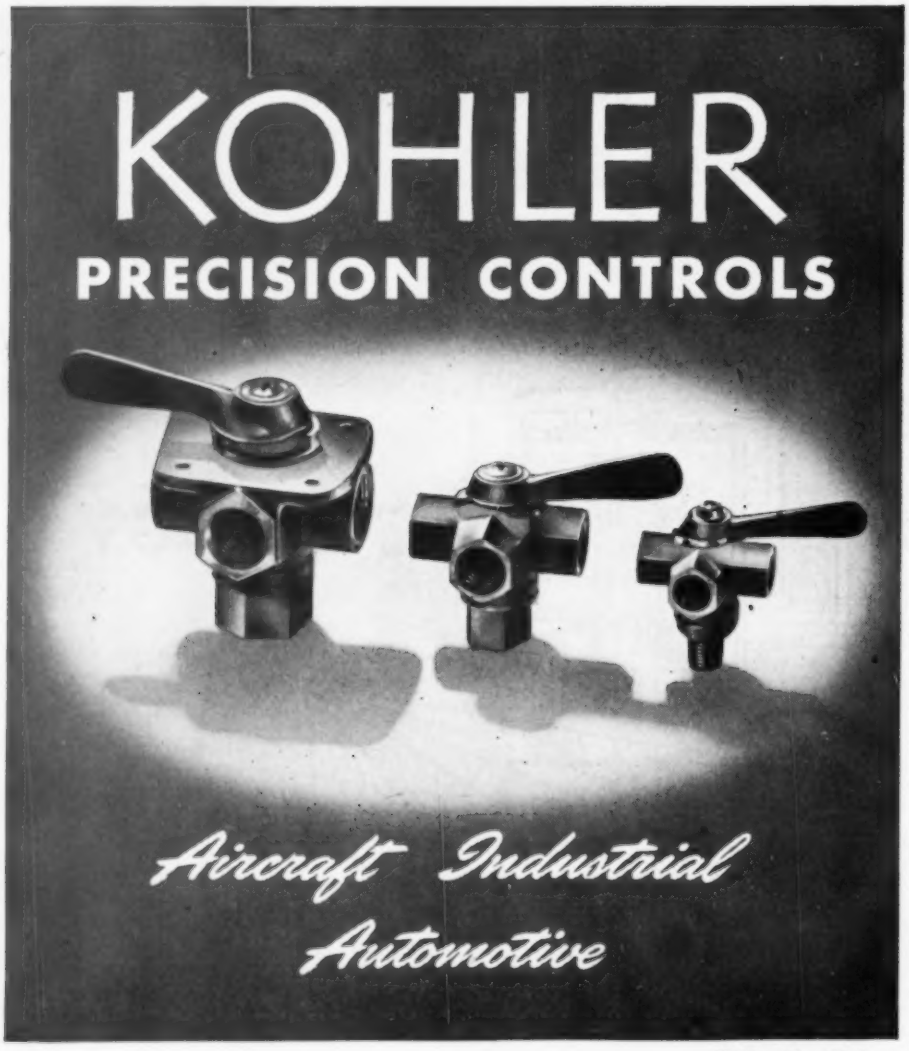


Kohler Plug Valves

Drain cock for a helicopter fuel system, hydraulic control valve for machine tool operation, shut-off valve for instrument air line or control plug valve for industrial test stand—whatever your need, you can, to your advantage, use Kohler Plug Valves. They will meet all your lower pressure installation and operating specifications.

Kohler Plug Valves have a stainless steel plug, precision lapped into a forged aluminum body—and are furnished with two, three or four ports, with or without mounting flanges, and with two or three way drilled plugs.

Write us regarding your next precision control requirements. We'll send information to help solve your design or production problem.

Kohler Co., Kohler, Wisconsin. Established 1873

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AIR-COOLED ENGINES • PRECISION CONTROLS

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Circle 6 on Reader Service Card

HYDRAULIC FLOW CONTROL VALVES which automatically control load descent rates at predetermined speeds, for use on material handling equipment are described in literature issued by Benton Harbor Engineering Works.

Circle 13 on Reader Service Card

PACKINGS made from specially treated and tanned steerhide and packings made from synthetic rubber are outlined in engineering catalogs released by Chicago Rawhide Mfg. Co.

Circle 21 on Reader Service Card

HYDRAULIC HOSE ASSEMBLIES for long dependable service, manufactured by Eastman Manufacturing Company, are described in Bulletin 103.

Circle 29 on Reader Service Card

FLEXIBLE HOSE for industrial or aircraft applications are the subject of catalogs prepared by Flex-O-Tube, Division of Meridan Corp.

Circle 32 on Reader Service Card

RUBBER O-RINGS, manufactured by the injection molding process, to meet extreme uniformity and tolerance requirements are featured in a bulletin offered by Minnesota Rubber & Gasket Co.

Circle 69 on Reader Service Card

AIR CONTROL VALVES are featured in a bulletin offered by Automatic Valve Co.

Circle 10 on Reader Service Card

Continued on page 12

# ANCHOR

## DUCTILE-SLEEVE, TWO-WIRE BRAID HOSE ASSEMBLIES

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**Factory assembled to your specifications** — you get just what you want — plus an extra margin of safety and dependability.

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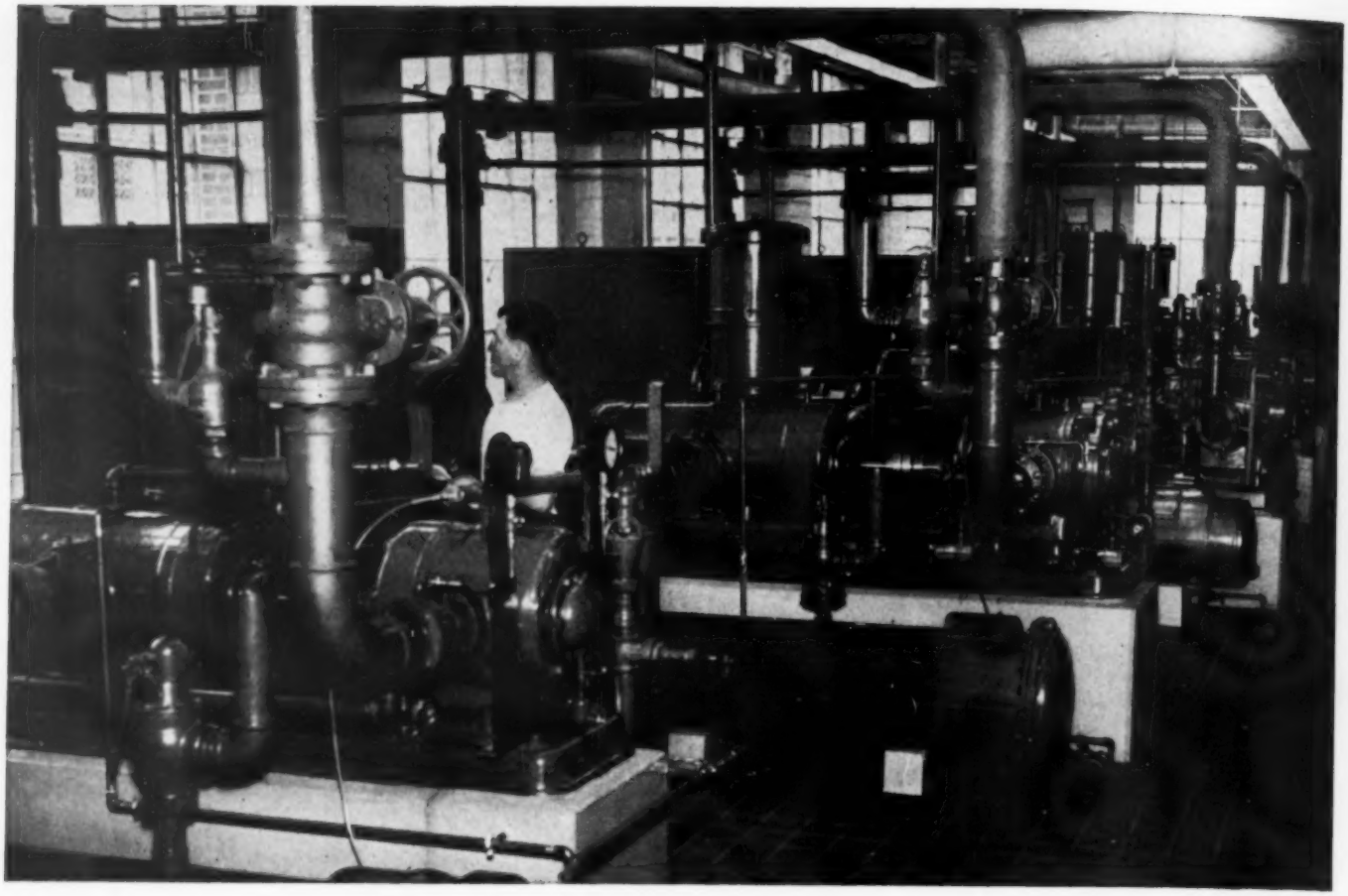

*mold Air Power to your needs as this founder does*

**Six Fuller Rotary Compressors work day after day at Textile Machine Works, Reading, Pa.**

Compressed air, produced in one central location, is used for many foundry operations at Textile Machine Works, Reading, Pa., makers of full-fashioned hosiery machinery.

Many molding operations are mechanized at Textile Machine Works, using compressed air. Sand supply-hopper gates are opened by compressed air, jolt-squeeze machines operate with compressed air, pattern plates are removed from molds with air—sand blasting, core making, compacting flask sand, handling push-pallet plates—a whole group of foundry operations simplified by the use of compressed air supplied by Fuller Rotary Compressors.

Starting with a two-stage Fuller Rotary Compressor in 1943, this company has added more compressors as production was increased, until recently the sixth unit was added, supplying a total of 6800 cfm at 125 psi. Each addition was a Fuller Rotary Compressor, a sure indication of reliability and economy of operation.

In your own foundry or process operations, compressed air can save time and money—especially when it is supplied by reliably efficient Fuller Rotary Compressors. Don't overlook the advantages of *air power*—put it to your work—write now for complete information.

**Fuller**

**FULLER COMPANY**
**Catasauqua, Pa.**

**Pioneers of high-efficiency vane-type rotary compressors**

*Branch Offices: Chicago • San Francisco • Los Angeles • Seattle • Birmingham*

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2046

# LESSONS IN HYDRAULICS

## The Beaver

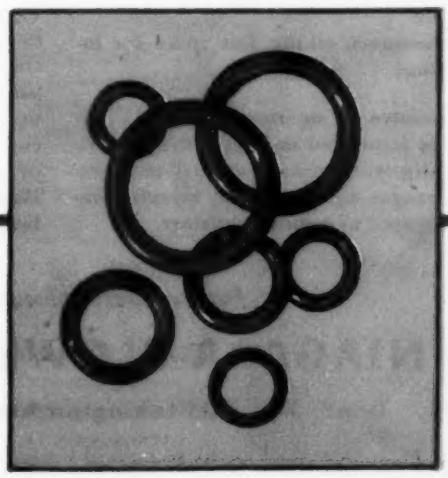
The beaver's building skill captures the imagination of engineers and naturalists alike. This industrious animal is undoubtedly the "woodland's greatest hydraulic engineer" In constructing dams and lodges, he cuts down small trees, dragging them into the water. Stripped of bark, these sticks and poles are shoved endwise into the dam or lodge structure. Stones are pushed or carried to the site and wedged into place, while mud is scooped up from the pond bottom and placed in crevices much like mortar. Beaver dams may be from 30 to 80 feet wide, and usually are strong enough to walk across. Lodges—often 20 feet in diameter—are built of interlocked sticks, stones and mud. *This watertight construction may actually be the forerunner of modern reinforced concrete—another lesson man has learned from nature.*

# WOODLAND'S GREATEST HYDRAULIC ENGINEER

Many products have design features requiring a hydraulic seal with special properties in addition to close tolerances and extreme uniformity. If yours is such a product, you'll want to know more about *injection molded* Minnesota O-Rings. Available in numerous compounds of natural or synthetic rubber, Minnesota O-Rings have great tensile strength, extreme capacity for pressure, and high resistance to compression set, abrasion, and oil swelling. Check these examples of successful installations in air, gas, and hydraulic systems: dispensing mechanisms . . . hydraulic rams and valves . . . air cylinders . . . remote control mechanisms . . . spraying equipment . . . gasoline and steam engines . . . and water pumps. Minnesota O-Rings are the choice of industries leading engineers and product designers. For prompt analysis and quotation on your requirements, send us your blue prints or specifications.

INJECTION MOLDED MINNESOTA O-RINGS

Minnesota Rubber's exclusive injection molding process produces O-Rings and other small rubber parts to meet extreme uniformity and tolerance requirements . . . and at low average prices. *Send for bulletin on injection molded Minnesota O-Rings.*



**MINNESOTA RUBBER & GASKET CO.**

3630 Wooddale Ave. • Minneapolis 16, Minn. • Phone WHittier 6511

AFFILIATED WITH MINNESOTA SILICONE RUBBER CO. • OFFICES IN PRINCIPAL CITIES

# This NEW METHOD DRIES AIR

## PRECISELY as you want it

- to control your product's quality
- to prevent condensation on your product or material
- to prevent changes due to moist air in contact with your product
- to protect your material from dampness
- to protect your processing of moisture-sensitive material
- to DRY your material or product
- to pack or store your product safe from moisture damage
- to get exact moisture control for the precise atmosphere condition you need
- to provide precise atmospheric conditions for testing
- to increase your air conditioning capacity
- to DRY large quantities of fresh air from outdoors

***The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is***

**Best and most effective because . . .** it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

**Most reliable because . . .** the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

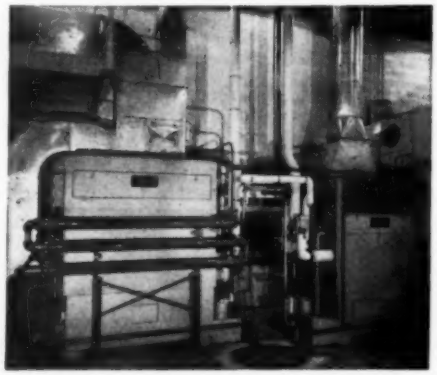
**Most flexible because . . .** you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

**Easiest to take care of because . . .** the apparatus is simple, parts are accessible, controls are trustworthy.

**Most compact,** taking less space for installation.

**Inexpensive to operate because . . .** no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

**The cleanest because . . .** no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.



**Niagara Controlled Humidity Air Conditioning**

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

***For complete information write***

## NIAGARA BLOWER COMPANY

**Dept. AH. 405 Lexington Ave., New York 17, N. Y.**

*District Engineers in Principal Cities of United States and Canada*


## *Free Literature Offered in this Month's Ads*

Continued

PRESSURE LOADED CARTRIDGE PUMPS, made in varying sizes and pressures up to 3000 psi, are featured in literature and performance charts available from Pesco Products Division, Borg Warner Corporation.

Circle 81 on Reader Service Card

TEST EQUIPMENT for a variety of test jobs is discussed in a catalog published by Greer Hydraulics, Inc.

Circle 41 on Reader Service Card

AIR PUMPS which can be used for either vacuum or pressure applications are described in a catalog and application-ideas booklet prepared by Gast Manufacturing Corp.

Circle 38 on Reader Service Card

TOGGLE VALVES, opened or closed with a single positive motion, to control gas or liquids at pressures up to 1000 psi, are the subject of catalog and data sheets offered by Hoke Incorporated.

Circle 48 on Reader Service Card

METALLIC ROD WIPER which protects cylinder rods, machine spindles, guide pins and locating pins, is described in literature issued by Hydraulic Accessories Co.

Circle 51 on Reader Service Card

AUTOMATIC AIR LINE FILTER, REGULATOR AND LUBRICATOR ASSEMBLY to protect air valves, cylinders and pneumatic tools, is discussed in literature prepared by M-B Products.

Circle 67 on Reader Service Card

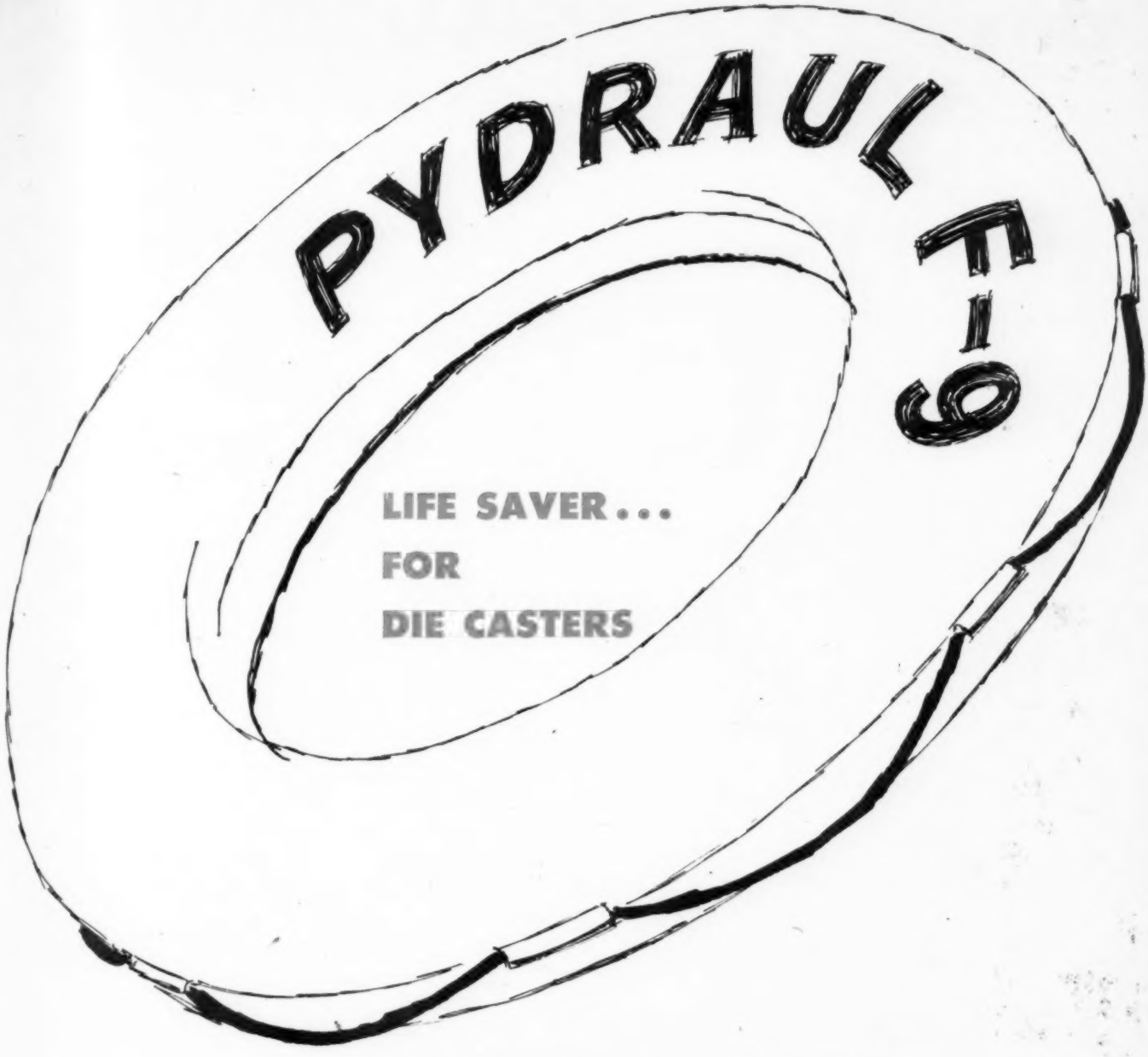
FIRE-RESISTANT HYDRAULIC FLUID for safe machine operation is specified in engineering report "Pydraul F-9" issued by Monsanto Chemical Company.

Circle 70 on Reader Service Card

GEAR PUMPS for hydraulic installations, have their features and capacities detailed in a 32-page pump catalog published by Brown & Sharpe Mfg. Co.

Circle 15 on Reader Service Card

Continued on page 16




When a discharge line parted recently on a West Coast die-casting machine, the hydraulic fluid—Monsanto's Pydraul F-9—sprayed into a hot zinc melting pot, drenched the machine operator and splattered several onlookers. Result: no fire, no injuries, no production loss.

Without *fire-resistant* Pydraul, the story would have been tragically different. Millions of dollars are lost each year in fires caused by escaping hydraulic fluid.

Why risk losing your plant in a fire of this kind? Under test, Pydraul will not flash or ignite even when poured on molten metal or sprayed into an oxyacetylene flame. Can you say the same about the fluid now in your hydraulic lines?

If not, then drain it out and put Pydraul in. No equipment changes are necessary.

Pydraul Reg. U. S. Pat. Off.

*Our specialists will help. Call the Monsanto office near you. Meanwhile, write us for "Pydraul F-9," an informative engineering report. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 800 North Twelfth Blvd., St. Louis 1, Mo.*

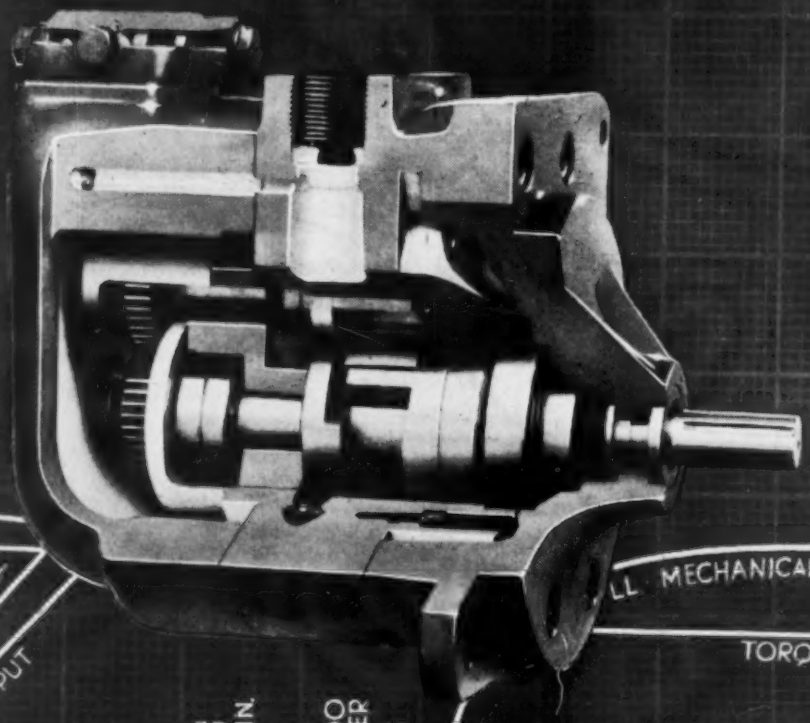
MONSANTO
CHEMICALS – PLASTICS

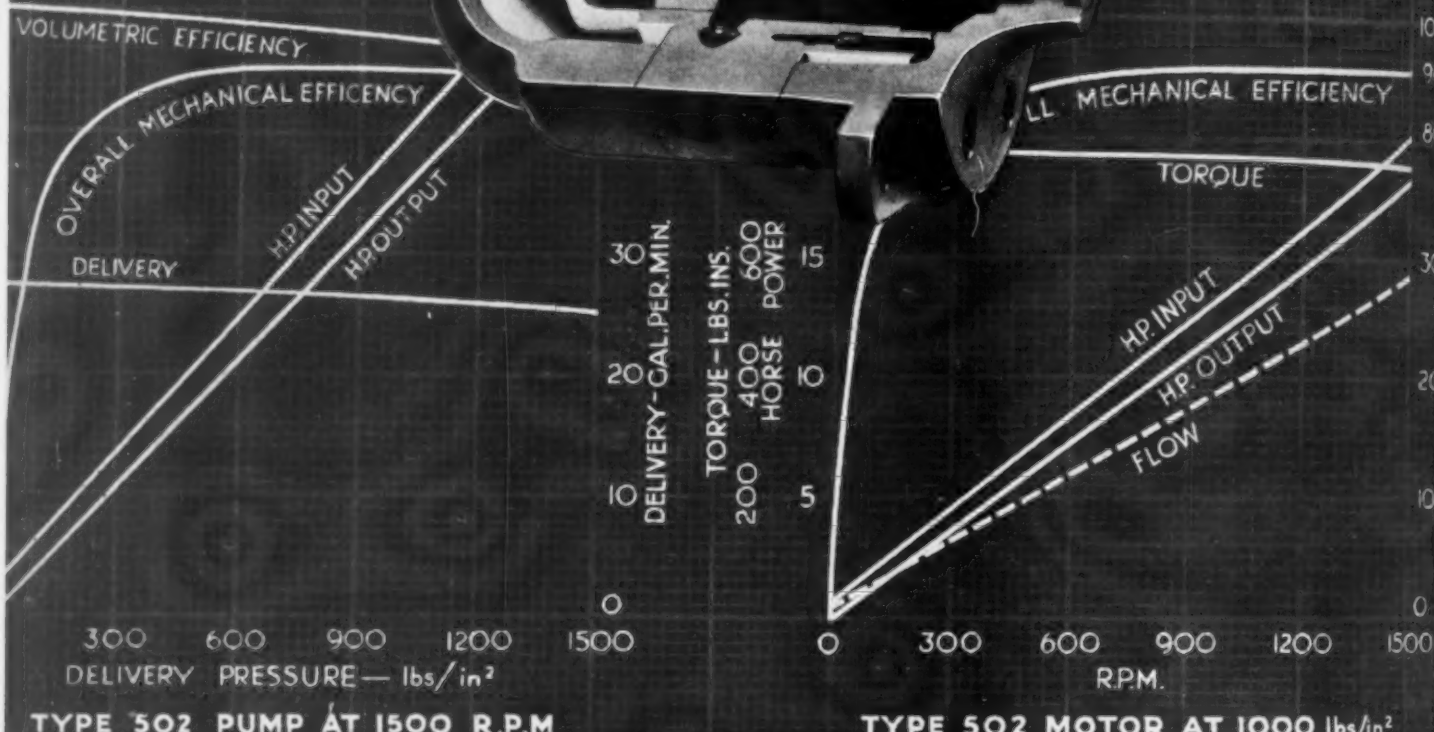
Serving Industry . . . Which Serves Mankind



Circle 70 on Reader Service Card

# ROTARY ABUTMENT UNITS






**Keelavite**
*hydraulics*

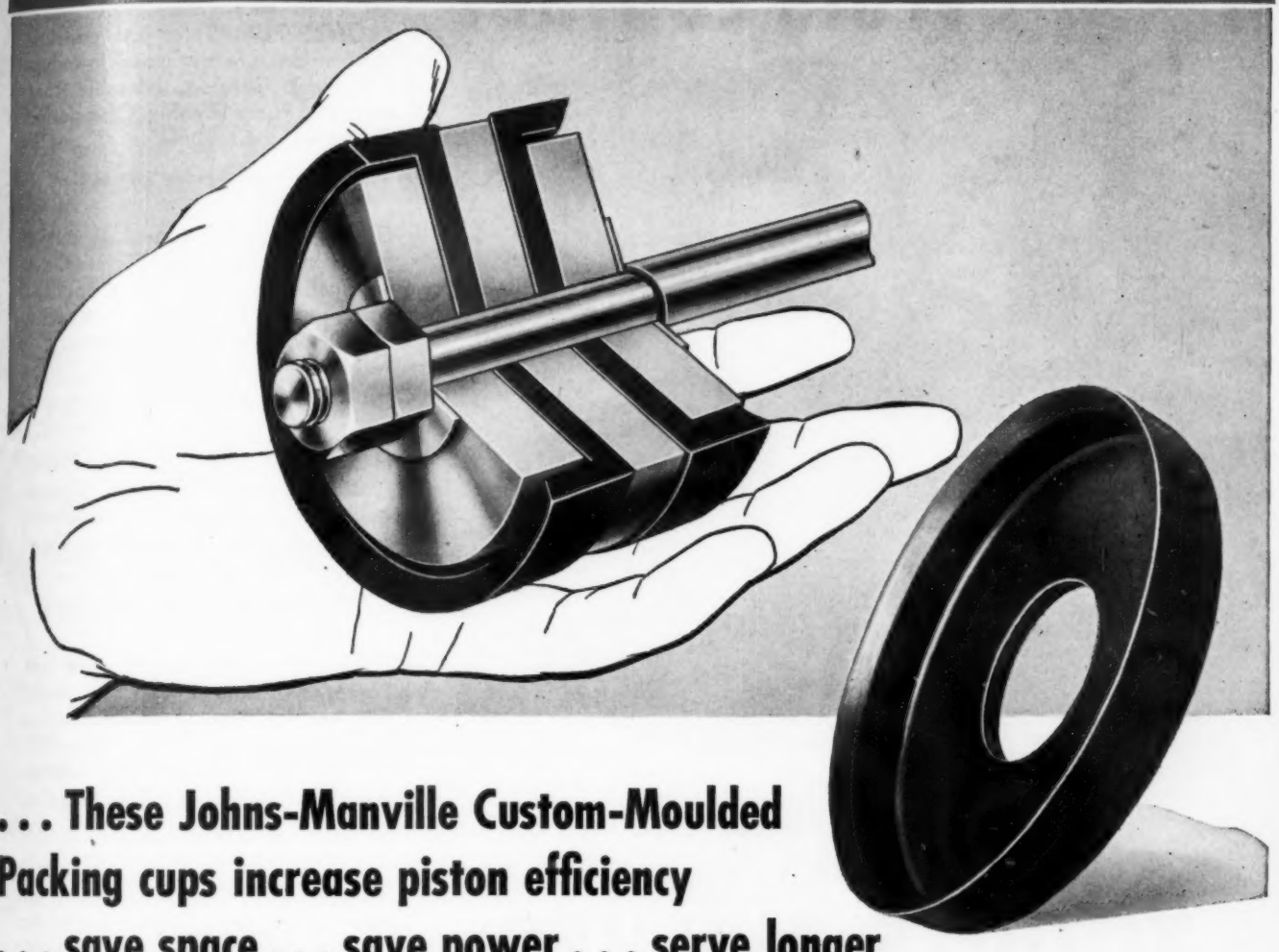
*For high performance with economy*

THE RECOGNISED AUTHORITY ON HYDRAULIC POWER TRANSMISSION

KEELAVITE ROTARY PUMPS & MOTORS LIMITED
ALLESLEY COVENTRY
Phone:- MERIDEN 225-6 & 384

Cogent

# Looking for a more efficient piston design?



## . . . These Johns-Manville Custom-Moulded Packing cups increase piston efficiency . . . save space . . . save power . . . serve longer

**TYPE A** . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.

**TYPE B** . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

**Johns-Manville PACKINGS & GASKETS**

FOR Fingertip
FLUID CONTROL

HOKE
TOGGLE VALVES

Opened or closed with a single, positive motion—like a light switch—these HOKE toggle valves will improve the design of your instrument panel or test stand. Use them to control gas or liquid, at pressures up to 1000 psi or in high vacuum, with no leakage through stem or seat. They are available in ⅛", ¼", ⅜" and ½" sizes, in brass or stainless steel. The seat material, normally synthetic rubber, may be altered to meet specific conditions. Both straight line and angle type are ideal for instrument panel installation and can be mounted easily and securely with a lock nut. Several types are available with plastic knobs of various colors, for quick identification of fluids. For fingertip fluid control—for time-saving, dependable, efficient performance—specify HOKE Toggle Valves. Write Hoke Inc., 187 S. Dean St., Englewood, N.J., for Catalog & Data Sheets.

HOKE
HOKE INCORPORATED
Fluid Control Specialists
ENGLEWOOD, NEW JERSEY

## Free Literature Offered in this Month's Ads

Continued

BRONZE PUMPS for low pressure applications are discussed in Industrial Pump Catalog, available from Industrial Pump Division, Oberdorfer Foundries, Inc.

Circle 74 on Reader Service Card

NYLON V-SEALS especially suited for sealing external and internal cylindrical surfaces in many applications, are the subject of Bulletin PU-827, published by Robertshaw-Fulton Controls Company.

Circle 88 on Reader Service Card

HOW TO SOLVE PUMPING PROBLEMS is the title of a 36-page guide which includes tables, charts and other data, prepared by Geo. D. Roper Corporation.

Circle 89 on Reader Service Card

FLEXIBLE COUPLINGS, which are compact in construction and maintain correct alignment between hydraulic pump and its electric motor, are illustrated in a catalog available from Lovejoy Flexible Coupling Co.

Circle 63 on Reader Service Card

BALANCED PRESSURE SEALS for pumps, flexible joints, hydraulic motors, and hydraulic actuating devices, capable of handling pressures up to 1500 psi, are detailed in Bulletin 7, issued by Sealol Corporation.

Circle 91 on Reader Service Card

QUICK CONNECT AND DISCONNECT COUPLERS of the Hi-Flow line, are the subject of a technical catalog offered by Snap-Tite Inc.

Circle 93 on Reader Service Card

FLUID MOTORS provide power by converting pressurized oil to rotary motion through a simple wobbler-piston arrangement. Descriptive booklet prepared by Sundstrand Hydraulics Division gives information on application, operation, performance and models.

Circle 98 on Reader Service Card

GENERAL PURPOSE PUMPS manufactured by Tuthill Pump Company are featured in a new catalog, No. 102.

Circle 105 on Reader Service Card

# ...with TYCOL lubricants on hand!

**They "Combed" the Lube Field for the *Right* Hydraulic Oil!**

A world-renowned plastics manufacturer – and a leading producer of fine-tooth combs – took plenty of time before specifying Tycol Aturbrio 60. With a world-wide product reputation and a half-century of experience they knew exactly what they wanted. Today Aturbrio is used exclusively in their Eastern plant for all hydraulic service – including Lester-Phoenix Injection Moulding machines with Vickers pumps. Tycol Aturbrio oils are unexcelled as turbine and electric motor oils . . . as well as hydraulic media. With maximum resistance to sludging and positive rust-inhibiting qualities – they're well worth your consideration. Just contact your local Tide Water Associated office!

***Over 300 Tycol industrial lubricants are at your disposal . . . engineered to fit the job!***

**REFINERS AND MARKETERS OF VEEDOL . . . THE WORLD'S MOST FAMOUS MOTOR OIL**

TYCOL
INDUSTRIAL LUBRICANTS

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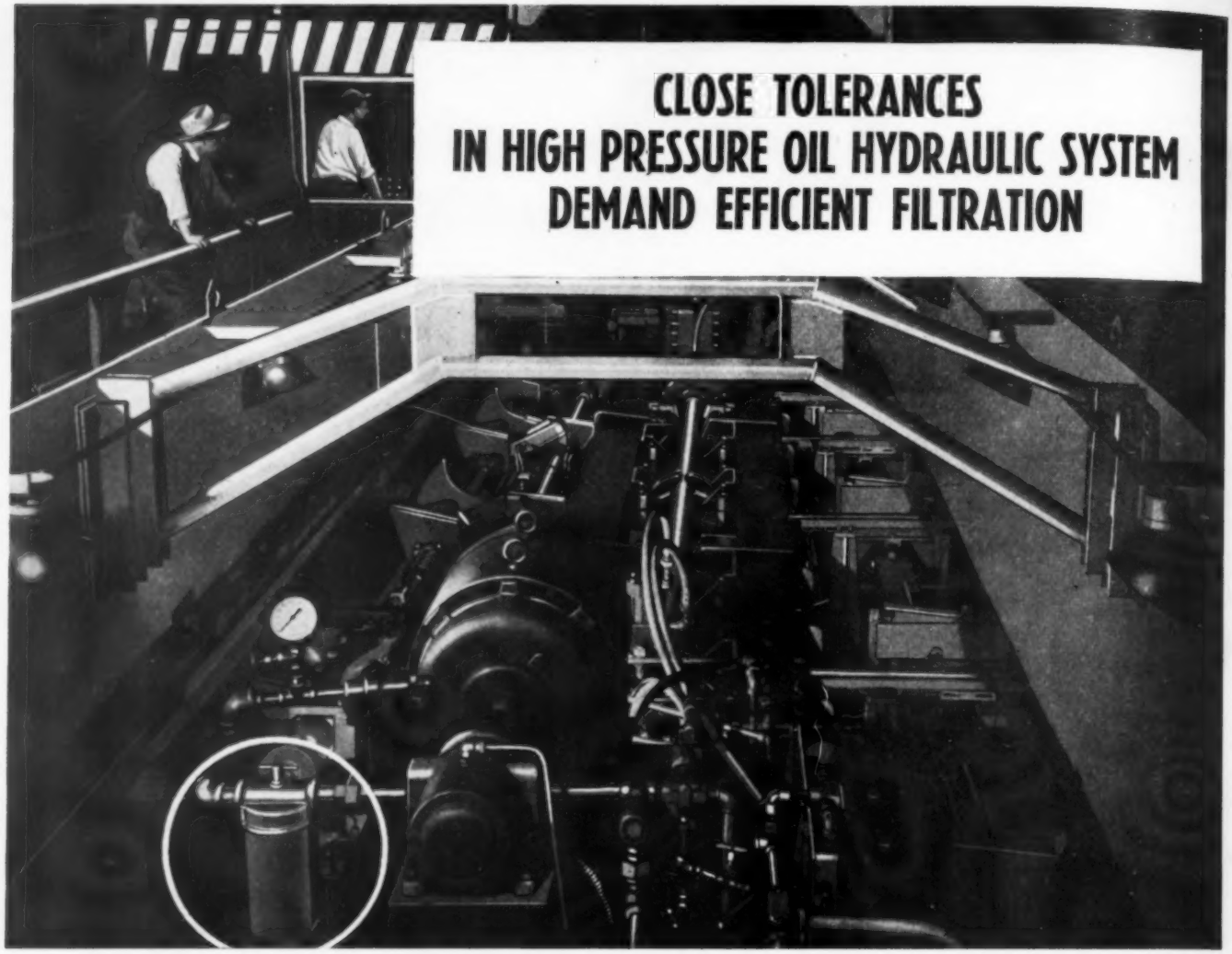
TIDE WATER ASSOCIATED OIL COMPANY
17 BATTERY PLACE · NEW YORK 4, N.Y.



# CLOSE TOLERANCES IN HIGH PRESSURE OIL HYDRAULIC SYSTEM DEMAND EFFICIENT FILTRATION

10,000 lb. automatic hydrostatic pipe testers at the Jones & Laughlin Steel Corporation's Aliquippa Works have Marvel Synclinal Line Type Filters installed at the suction end of the pumps on the unit.

Courtesy Jones & Laughlin Steel Corporation

# MARVEL *Synclinal* FILTERS

. . . proved their effectiveness recently when one of the motors on the automatic hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece of foreign matter contained in the oil could clog the circuit resulting in costly "down-time." These pieces of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all of the metal particles had been filtered out of the oil by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production can be costly in an operation of this size.

## Marvel *Synclinal* Design Assures Clean Oil Free of Foreign Matter

Everyday more manufacturers are using Marvel Synclinal Filters as Standard Equipment to keep the oil clean and free of foreign matter in hydraulic and low pressure systems. The reason being that Marvel Filters have demonstrated under severe conditions they operate efficiently and dependably. Both the sump and line type models are available in capacities of 5 to 100 g.p.m., and in wire mesh sizes from 30 to 200. The simplicity of design makes them easy to disassemble, clean and reassemble right on the job. It is not necessary to carry spare parts or cartridges in stock.

WATER FILTERS—Both our sump and line types have been designed for use in all water filtering applications with no change in the basic Synclinal design.

LINE TYPE (Cutaway)

SUMP TYPE (Cutaway)

**MARVEL** *Engineering Company*

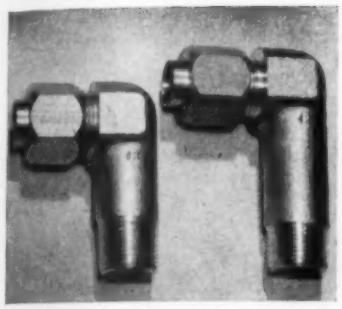
625 WEST JACKSON BLVD., CHICAGO 6, ILLINOIS

Write for Complete Engineering Data—Specify Oil or Water.

Meets J.I.C. Standards

# NEW PRODUCTS

**Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.**



### *TUBE FITTINGS*
### *. . . long and extra long elbow*

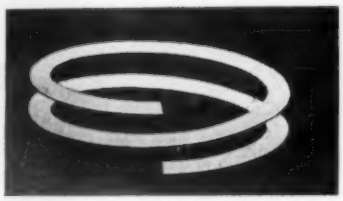
**Designation:** CC BTX & CCC BTX.

**Features:** The long and extra long elbows enable the designer to work within closer space limits. Shorter standard shaped elbows may be nested within the longer elbows to permit close, neat parallel lines. Although the standard stock of these fittings will be steel, the two new shapes are available on special order, in brass, stainless steel and aluminum. The fittings include body nut and sleeve.

**Application:** For use on industrial hydraulic systems, instrumentation, process piping in refineries, power and chemical plants.

**The Parker Appliance Co.**
**Cleveland, Ohio**

Circle 136 on Reader Service Card



### *BACK-UP RINGS*
### *. . . made of Teflon*

**Features:** Spirally machined of Teflon, back-up rings have been designed to prevent extrusion of O-rings. The Teflon rings have a high impact strength at temperatures from –100 degrees F. to + 500 degrees F.; are non-corrosive, non-adhering, non-fraying, inert to most chemicals and self-lubricating. They are made for all O-ring sizes to AN drawings 6227 and 6230.

**The Garlock Packing Co.**
**Palmyra, New York**

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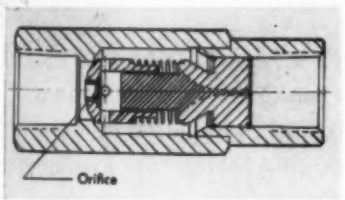


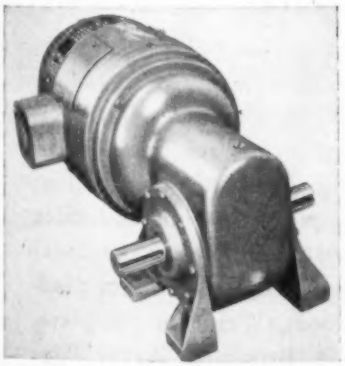

### *RESTRICTOR VALVE*
### *. . . with free return flow*

**Design:** Is a check valve with an orifice in the check poppet. Free flow is permitted in one direction by the check valve, reverse flow closes the check and must pass through the orifice. The size of the orifice is made to suit the application.

**Sizes:** Available are ¼, ⅜, ½ and ¾ inch pipe.

**Fluid Controls, Inc.**
**Mentor, Ohio**

Circle 138 on Reader Service Card



### *RIGHT-ANGLE MOTOREDUCER*
### *. . . has shorter overall length*

**Sizes:** Available in ½, ¾, 1 and 1 ½ hp ratings with speed reductions to as low as 18, 24, 36 and 58 rpm respectively. Foot or ring mounting optional.

**Features:** The unit permits the simultaneous use of as many as 3 output shafts from the same motor, when desired. One high speed take-off directly from the motor shaft, and either 1 or 2 low-speed take-offs from the reducer. Drive motor can be either squirrel cage, slip ring, multi-speed or fluid-shaft, in either drip proof, splash proof or totally enclosed designs.

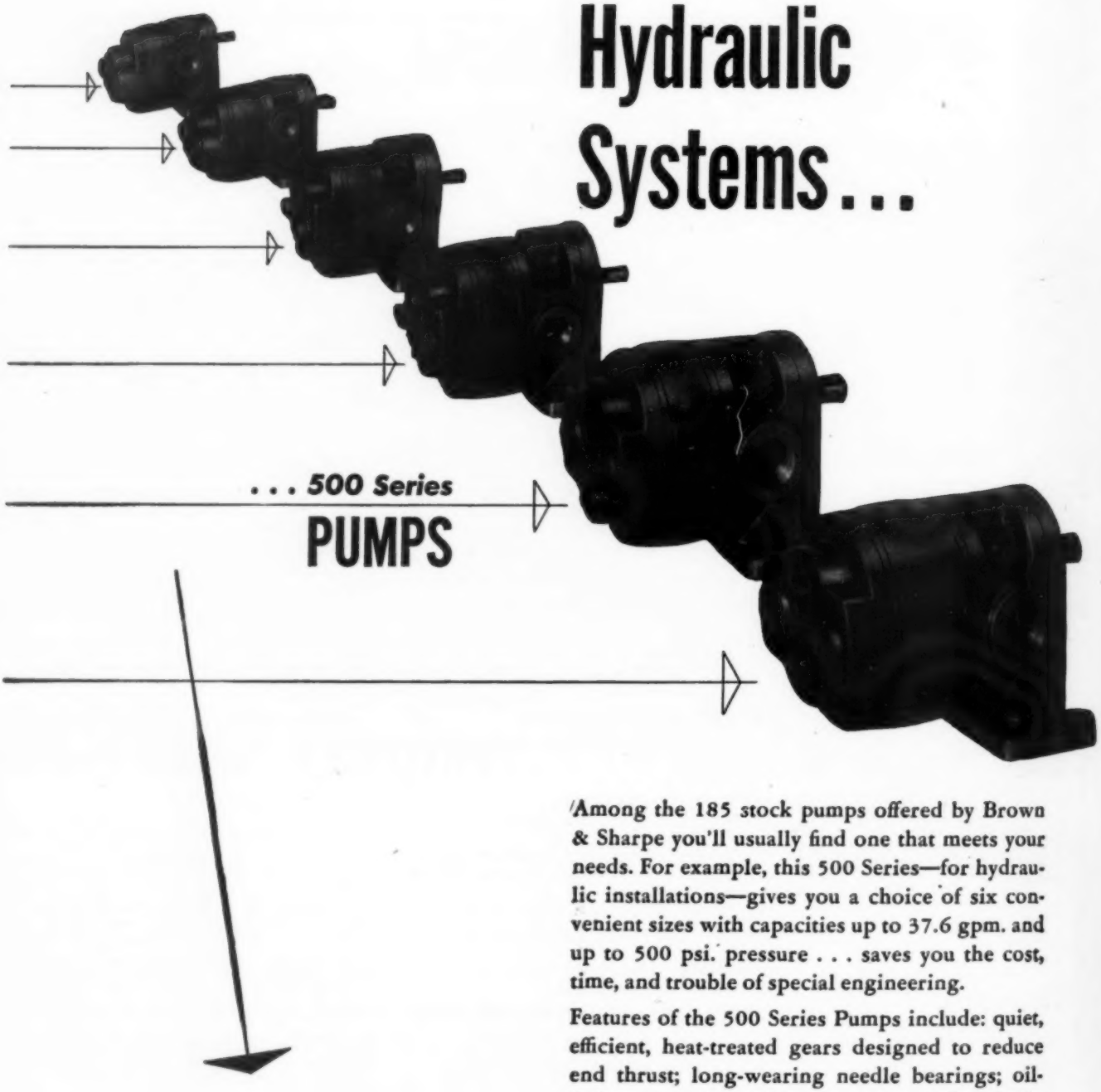
**Service:** The purpose of this unit is to convert a motor's high speed into a low speed, high torque output.

**Reuland Electric Company**
**Alhambra, California**

Circle 139 on Reader Service Card

*For more New Product Information turn to page* 88

# Engineered to fit your Hydraulic Systems...



. . . 500 Series
PUMPS

Among the 185 stock pumps offered by Brown & Sharpe you'll usually find one that meets your needs. For example, this 500 Series—for hydraulic installations—gives you a choice of six convenient sizes with capacities up to 37.6 gpm. and up to 500 psi. pressure . . . saves you the cost, time, and trouble of special engineering.

Features of the 500 Series Pumps include: quiet, efficient, heat-treated gears designed to reduce end thrust; long-wearing needle bearings; oil-tight, ground, housing joints; reversible back-drain allows changing direction of rotation; suction and discharge ports on ends and sides of pumps provide convenient piping combinations; adaptable flanged stand that meets practically all mounting needs. Write for complete, 32-page, Pump Catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

**Brown & Sharpe** B·S

*BUY THROUGH YOUR LOCAL DISTRIBUTOR*

# PERFORMANCE

## GUARANTEED

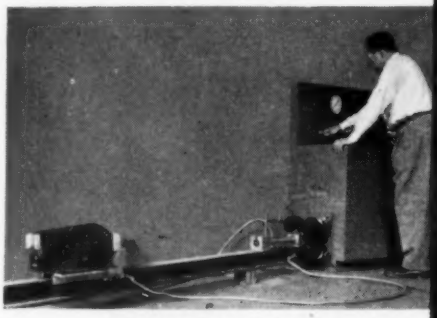
More and more knowledge about the performance of Bendix-Pacific products—with even more exactness than could be secured in actual service—is being amassed by Bendix-Pacific engineers. Every practical testing method can be created, controlled and precisely calibrated in the Bendix-Pacific laboratories. Temperature, altitude, humidity, pressure, acceleration, vibration, oxidation, strength and shock are among the conditions which Bendix-Pacific hydraulic, electro-mechanical and electronic products must successfully withstand.

*This is the way Bendix-Pacific is writing a better performance warranty on its products.*

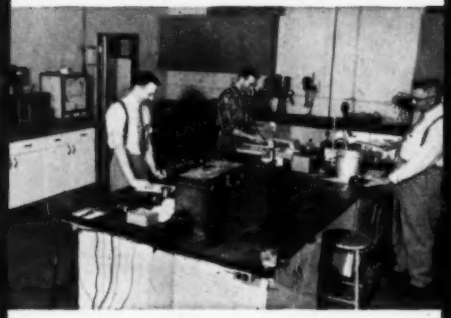
RADAR TOWER

SONAR TANK

SHAKE TABLE



ACCELERATION MACHINE



MINIATURIZATION

ENVIRONMENTAL TESTS

CHEMICAL LABORATORY

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SERVO VALVE TEST STAND

Bendix

Pacific Division

Bendix Aviation Corporation

NORTH HOLLYWOOD, CALIF.

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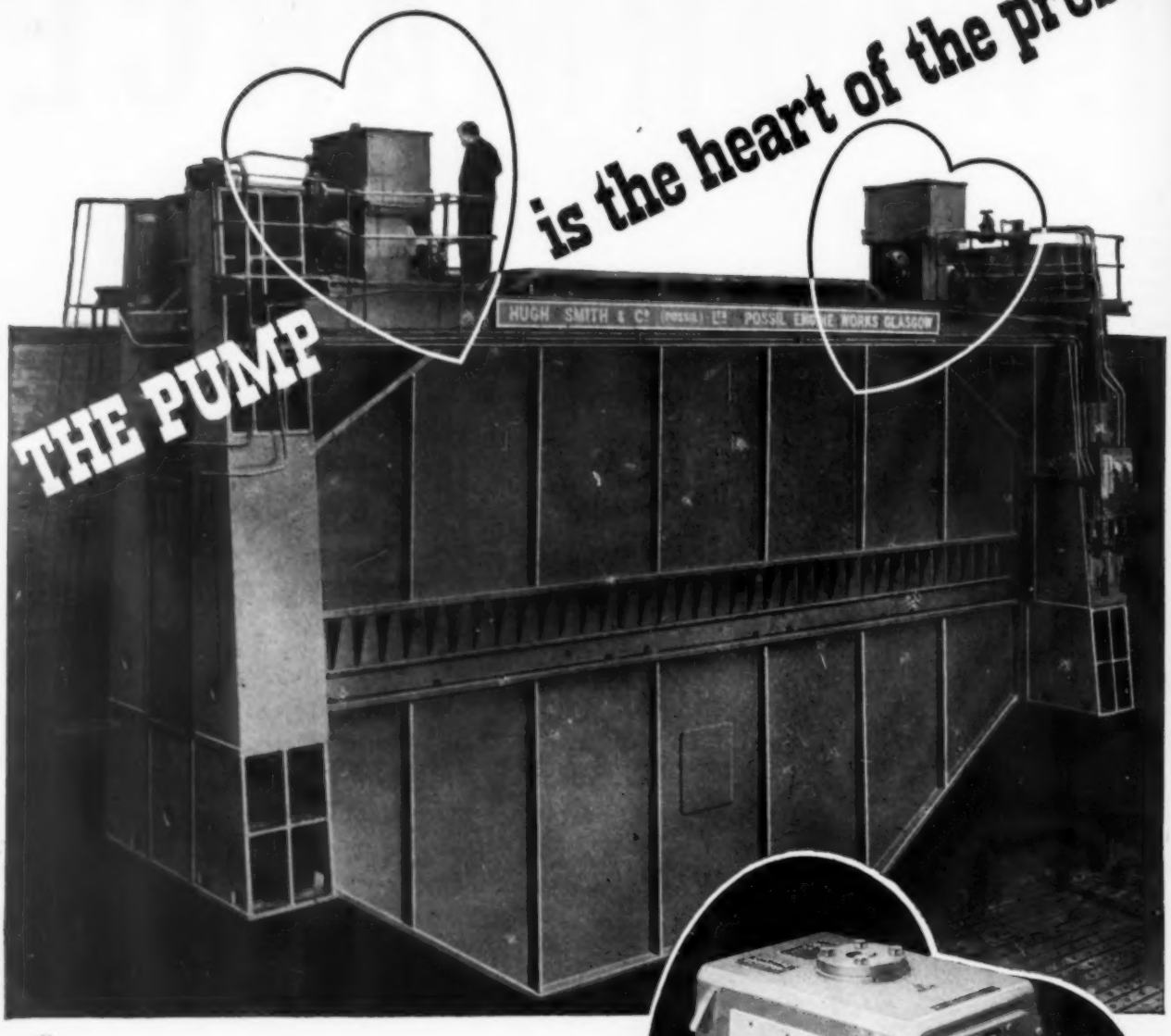
AIRCRAFT HYDRAULIC CONTROLS • AIRBORNE RADAR • SONAR • INDUSTRIAL HYDRAULIC CONTROLS • TELEMETERING • ELECTRO-MECHANICAL EQUIPMENT

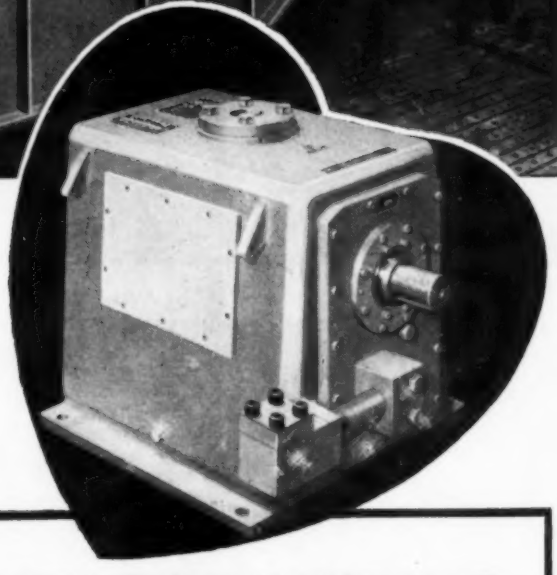
# THE PUMP is the heart of the press . .




A 1,200-ton self-contained press by Hugh Smith & Co. (Possil), Ltd., designed for the manufacture of corrugated bulkheads for ships, and is also applicable to general flanging work in lengths up to 40ft.

This fine example of British press design incorporates "Electraulic" pumps and controls for :—

(*a*) Consistent and unfailing performance.
(*b*) Power output variable as required.
(*c*) Instantaneous response to finger tip control.
(*d*) Economy.
(*e*) Completely self-contained unit.



**ELECTRAULIC**
REGD. TRADE MARK
***HIGH SPEED***
**HYDRAULIC PUMPS**

**TOWLER BROS.** (Patents) **LTD. RODLEY, Nr. LEEDS, ENGLAND**
Sole Agents: U.S.A. and CANADA: MACMILLIN ENGINEERING CORPORATION
1737 HOWARD STREET, CHICAGO 26, ILL. • Ambassador 2-1191



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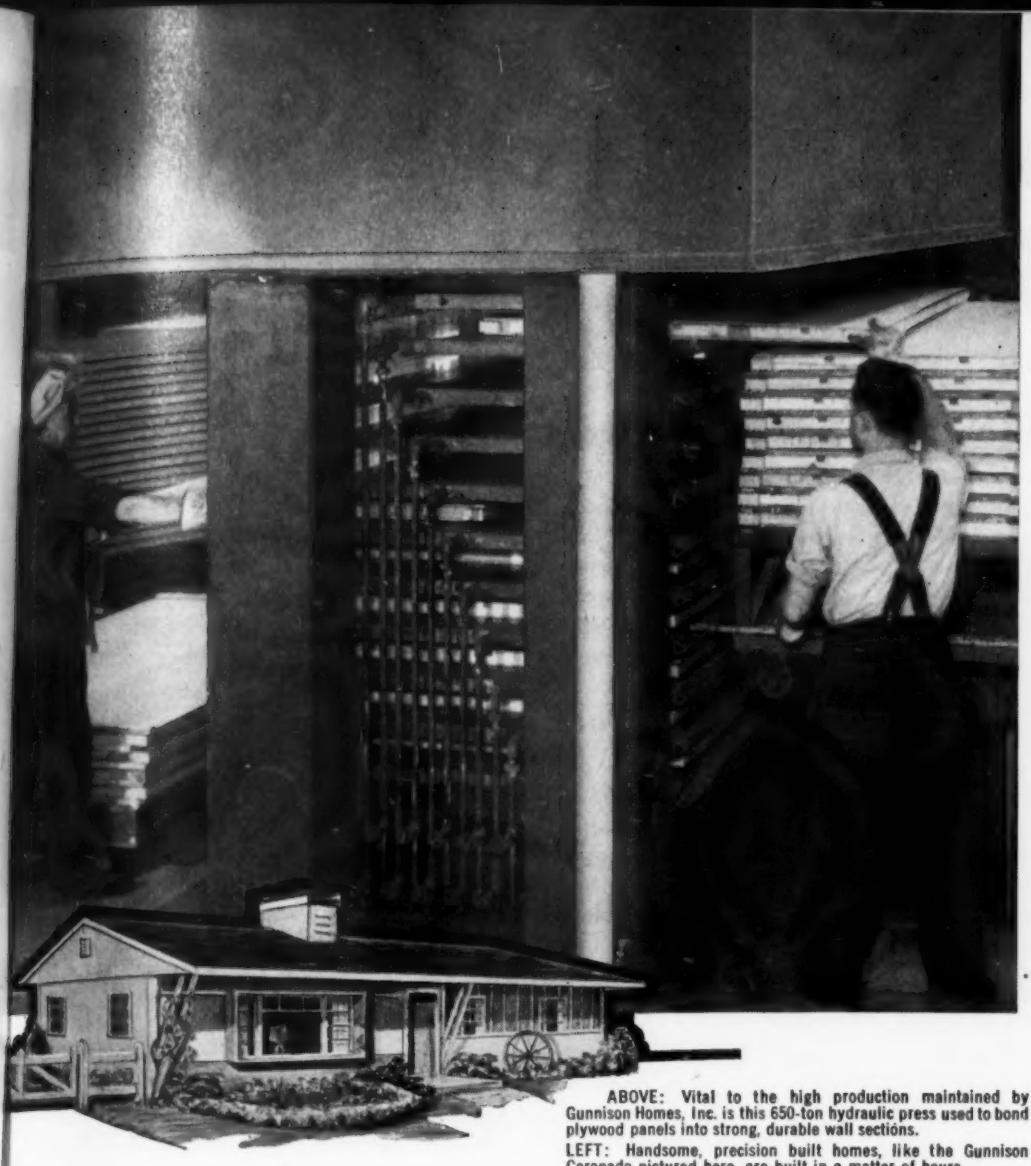


ABOVE: Vital to the high production maintained by Gunnison Homes, Inc. is this 650-ton hydraulic press used to bond plywood panels into strong, durable wall sections.

LEFT: Handsome, precision built homes, like the Gunnison Coronado pictured here, are built in a matter of hours.

## Answers a pressing need for Gunnison Homes, Inc. . . .

● Gunnison Homes, Inc., situated in New Albany, Indiana, is one of the leaders in the field of manufactured homes. Key to continuous production of precision built homes at the New Albany plant is the 650-ton hydraulic press, shown above, which was installed in 1947. This press processes ten plywood panels every cycle by the combination of heat and pressure . . . a tough job and one requiring reliable hydraulic performance to maintain production schedules.

**STANOIL**
TRADE MARK
**Industrial Oil**

STANOIL Industrial Oil was installed in the press when it was put into operation six years ago. STANOIL has stood the test of severe operation . . . with no evidence of oil deterioration being found during a recent inspection of the hydraulic system. Operation has been efficient. Minimum make-up oil has been needed to maintain the oil capacity of 450 gallons.

Find how STANOIL can benefit you by discussing this multi-purpose oil with a Standard lubrication specialist. You can contact him by phoning your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Ill.

## What's YOUR problem?

**Ralph E. Murnahan,** of Standard Oil's Evansville office, is the lubrication specialist who keeps in constant contact with Gunnison Homes to make certain that there is no interruption of operation due to lubrication difficulties.

He is one of many lubrication specialists who make their headquarters in Standard's offices throughout the Midwest. These men have been specially trained in Standard's Lubrication Engineering Schools and, in addition, have a wealth of on-the-job experience.

To obtain the service of the lubrication specialist in your area, you need only call your local Standard Oil office. The lubrication specialist will discuss your lubrication problems with you . . . at no obligation to you, of course. He has a complete line of petroleum products to offer you, including:

**SUPERLA Greases**—Available in a wide range of consistency grades and in both lime-soap and soda-soap types. SUPERLA Greases cover a wide range of operations. These efficient products are comparable in quality with the highest type of special greases.

**STANOLITH Greases**—Because these unique lithium soap products possess the heat resistant properties of soda-soap greases and the water resistant properties of lime-soap greases, they offer a solution to lubrication problems caused by the presence of both heat and water.

**STANDARD OIL COMPANY** STANDARD *(Indiana)*

APPLIED HYDRAULICS

# Trends IN THE FLUID POWER FIELD

## New Packing Developments with Impregnated Materials

For hydraulic and pneumatic systems, several leather packing manufacturers have now developed a process of impregnating leather with rubber. This development raises the maximum operating temperature of the packing to over 200 F, as compared to the 150 F top rating of wax impregnated leather. The amount of impregnation with rubber can be carefully regulated to control porosity and provide self lubrication of the packing. The new packings combine the advantages of resistance to abrasion and low friction given by leather with the improved resilience and resistance to temperature which rubber offers.

## More Hydraulic Elevators for Industrial Buildings

What has given the hydraulic elevator its comeback? Decentralization of industry seems to be the answer. Hydraulic elevators are suited to low factory buildings of the type being built today. Oil hydraulic pump designers have been solving the noise problem and the elevator people have solved the automatic leveling problem. Installation costs of oil driven elevators are comparable with the traction type. However, because no penthouse is needed some installations of hydraulic elevators are cheaper, and operating and maintenance expense is less.

## Market for Heavy Presses Gets Cut by the Air Force

Part of the Air Force's initial $386-million heavy press program has been canceled. Seven of the original 17 giant presses have been eliminated. The Air Force says the cut-back resulted from a reappraisal of aircraft needs and because some technical problems are still unsolved. As it now stands, the program calls for four forging presses—two at 35,000 tons, two at 50,000 tons—and six extrusion presses—three at 8000 tons, two at 12,000 tons and one at 13,200 tons.

## The Thermal Barrier Challenges Component Designers

Hydraulic applications in the aircraft industry are faced with a very serious high temperature problem. In some aspects, the thermal barrier poses as tough problems as did the sonic barrier. A group of papers at the last SAE national aeronautic meeting highlighted some of the specific problems that pump designers, packing and fluid suppliers face at the moment. The trend is toward higher operating temperatures. Components and materials must be designed, compounded or created that will operate efficiently and reliably at higher temperatures. New packings must be developed and tested. The search for a satisfactory high temperature hydraulic fluid is unremitting. Pump and valve designs must meet tougher and tougher operating conditions. However, the thermal barrier is being assailed by a well coordinated group of manufacturers, plane builders and the services. A number of problems of design, compounds, materials and fluids are being tackled simultaneously; each group has a high degree of confidence that the other groups will come up with answers that, added together, will meet the challenge of the thermal barrier.

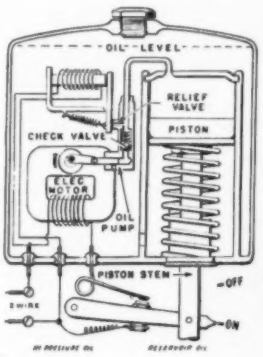
## Valve Specifications to Assist the Machine Designer

With the establishment of the National Fluid Power Association, a number of industry-wide problems in industrial hydraulics and pneumatics will find a focal point. Such problems as cylinder packings and valve nomenclature and specifications can be worked on cooperatively by directly interested manufacturers. General agreement on valve nomenclature by manufacturers of industrial hydraulic valves should, logically, receive early attention. Valve specifications, standard catalog data in particular, need reviewing to give additional information that well informed buyers are beginning to ask. For example: What is the operating time of solenoid valves? What is the pressure drop through valves?

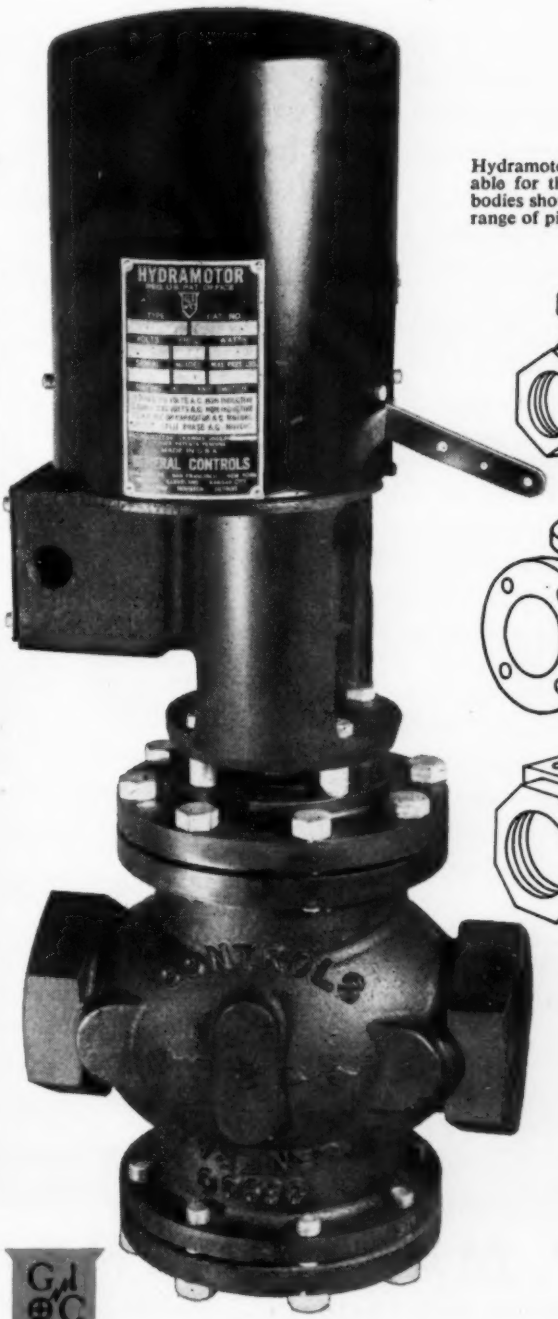
# *The motor valve for every industrial need*

# HYDRAMOTOR*

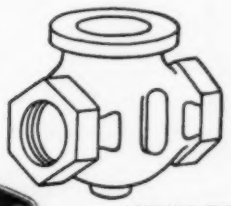
Featuring two-wire, positive, automatic shut-off in case of current failure, General Controls' Hydramotor* Valves perform dependably under all kinds of pressure, temperature and flow conditions. Lifetime-sealed in oil against dust, grit and weather, the Hydramotor operating mechanism applies electro-hydraulic power direct to the valve, thus eliminating the need for a complicated gear train. With only three moving parts, General Controls' Hydramotor* Valves require no lubrication or maintenance. For safe, economical, all-weather control of gases, oils, steam and heavy viscous liquids, the *best* valve is a General Controls Hydramotor.*



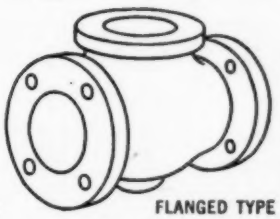

There are no gears in the Hydramotor* operator mechanism. A motor-driven hydraulic pump actuates a piston in a control cylinder, moving the main valve with maximum mechanical efficiency. Valve will handle line pressure up to 3000 psi.



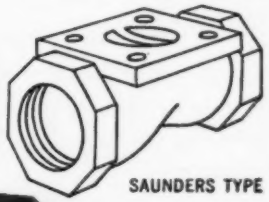

Hydramotor operators are available for the basic types of valve bodies shown below with complete range of pipe sizes from ⅜" to 6"



SCREWED TYPE



FLANGED TYPE



SAUNDERS TYPE

## General Controls

## G series

## Hydramotor Valves

**GENERAL CONTROLS**

**Glendale, California • Skokie, Illinois**

Manufacturers of Automatic Pressure, Temperature, Level and Flow Controls for Heating, Home Appliances, Refrigeration, Industrial and Aircraft Applications.

**FACTORY BRANCHES IN 34 PRINCIPAL CITIES**

*See your classified telephone directory.*

**Hydramotor is a registered tradename.*

MARSH adds something NEW!

MARSH BEST SINCE 1900 LEATHER PACKINGS

**MARSH research leads again with a new *improved* quality impregnated mechanical leather!**

Marsh leads in better Leather Packings, because –

- Only packing leather specifically tanned to Marsh rigid specifications is used.
- Marsh continuing research on impregnations and quality control give you new packing material values – to improve the efficiency and acceptance of your products.

Marsh research has developed new, tougher – wear, age and extreme temperature resistant – mechanical leather packings which combine resilience and tightness with low friction.

**ENGINEERING AND CONSULTING SERVICE**

If you seal oil, water, air, vacuum, gas, gasoline, naptha, alcohol or other fluids, ask Marsh for field engineering service.

FEATURES: Low coefficient of friction — both static and running, greater wear resistance, tighter sealing, better high and low temperature stability, improved lubrication potentials, longer life.

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1900 EUCLID AVENUE, CLEVELAND 15, OHIO

# LETTERS to the Editor

### Pressure Drops in Hydraulic Systems

It would be greatly appreciated if you could tell me where I could get a set of nomographs to quickly determine pressure drops in hydraulic systems.

ALBERT MIGLIACCIO,
Head, Prototype Development Section,
U.S. N.O.T.S.
Pasadena, Calif.

*A nomograph or chart for determining pressure drops in hydraulic systems is published by The Oilgear Company in their Bulletin* 90010, *"Hydraulic Piping—Determining Pressure Drop and Power Losses." This company maintains a district office at* 551 *Roosevelt Building,* 727 *West 7th St., Los Angeles* 17, *Calif. from which you may obtain a copy of this Bulletin.*

**Prize Paper Winners,**

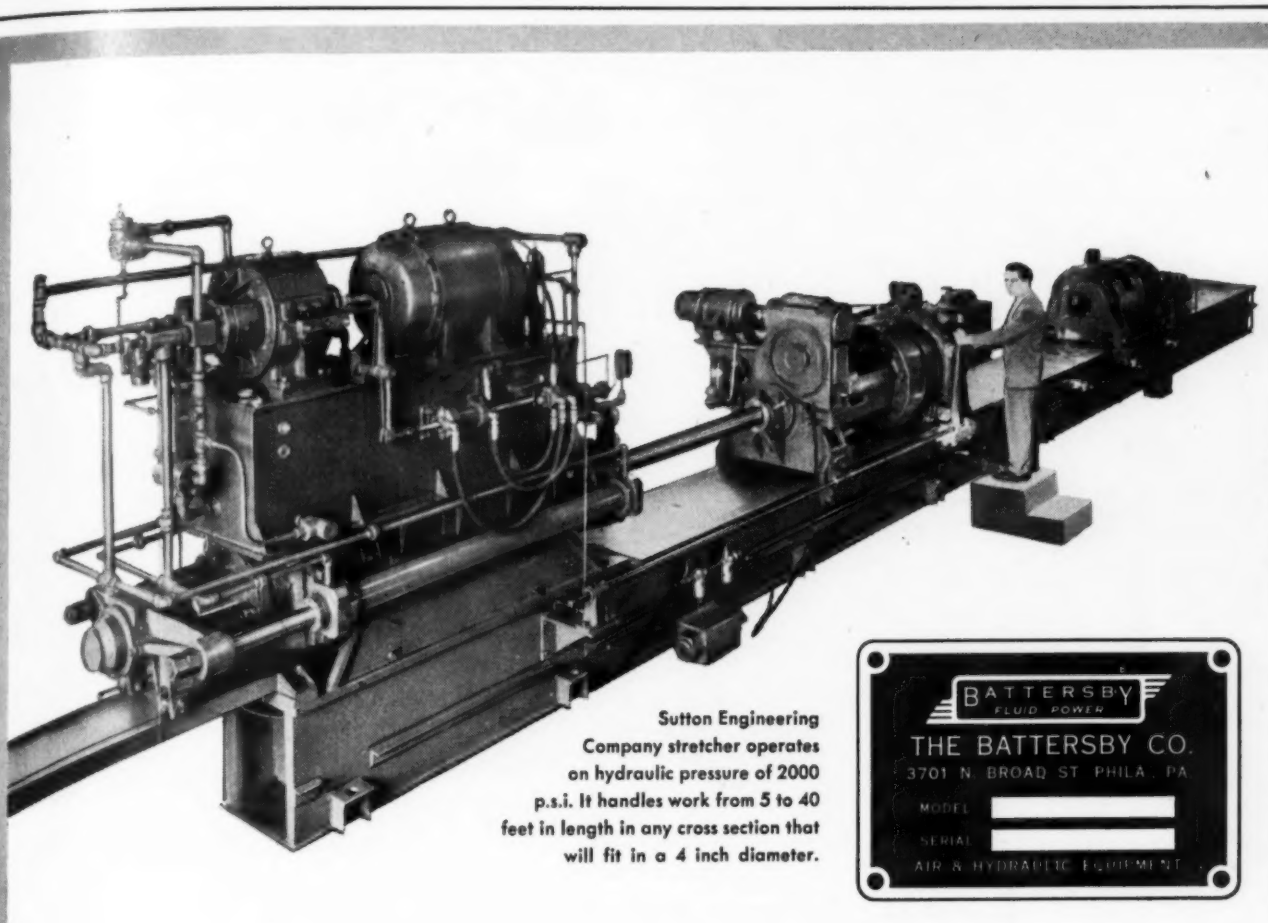
The winners of the APPLIED HYDRAULICS Prize Paper Contest, as well as entries that won Honorable Mention, will be announced in the October issue. The First Prize winning paper will be published in that issue.

### Valve Operating Time

We are looking for information concerning the time involved in operating four-way valves in hydraulic circuits. We are interested in test figures of 1½ inch double solenoid operated, spring return to neutral four-way valves, either AC or DC operated. We would like to know the time it takes to operate the solenoid and to shift the valve plunger from neutral to operating position. It would also be important to know the

Continued on page 30

## WHEN IT'S HIGH PRESSURE IT'S **AMERICAN!**




Sutton Engineering Company stretcher operates on hydraulic pressure of 2000 p.s.i. It handles work from 5 to 40 feet in length in any cross section that will fit in a 4 inch diameter.

# AE Representative puts the stretch in a stretcher

A 100-ton straightening, detwisting and metal conditioning machine demands not only power but extreme flexibility, as well. Our Eastern Representative, The Battersby Company of Philadelphia, answered these demands to the letter with a Hele-Shaw Fluid Power pumping unit and complete hydraulic system. The unit was both designed and manufactured for the Sutton Engineering Company of Bellefonte, Pa.

The pump itself is the famous Hele-Shaw radial-piston, servo controlled, variable-displacement fluid power generator. Discharge is infinitely variable from zero to maximum... can be reversed instantly or gradually.

Whatever your problem in high pressure hydraulic pumping systems, there's an American Engineering hydraulic equipment representative to save you time and expense in both engineering and construction. He's right in your area, too... offering you *local* responsibility for continuous efficient service.

Mail the coupon for full information about Hele-Shaw for variable displacement to 110 g.p.m., (pressures to 3000 p.s.i.); on the Hydramite for constant displacement to 10 g.p.m., (pressures to 5000 p.s.i.).

**AMERICAN ENGINEERING**
**COMPANY**
PHILADELPHIA 25, PENNA.

In Canada: Affiliated Engineering Corporations, Ltd., Montreal 2, P.Q.

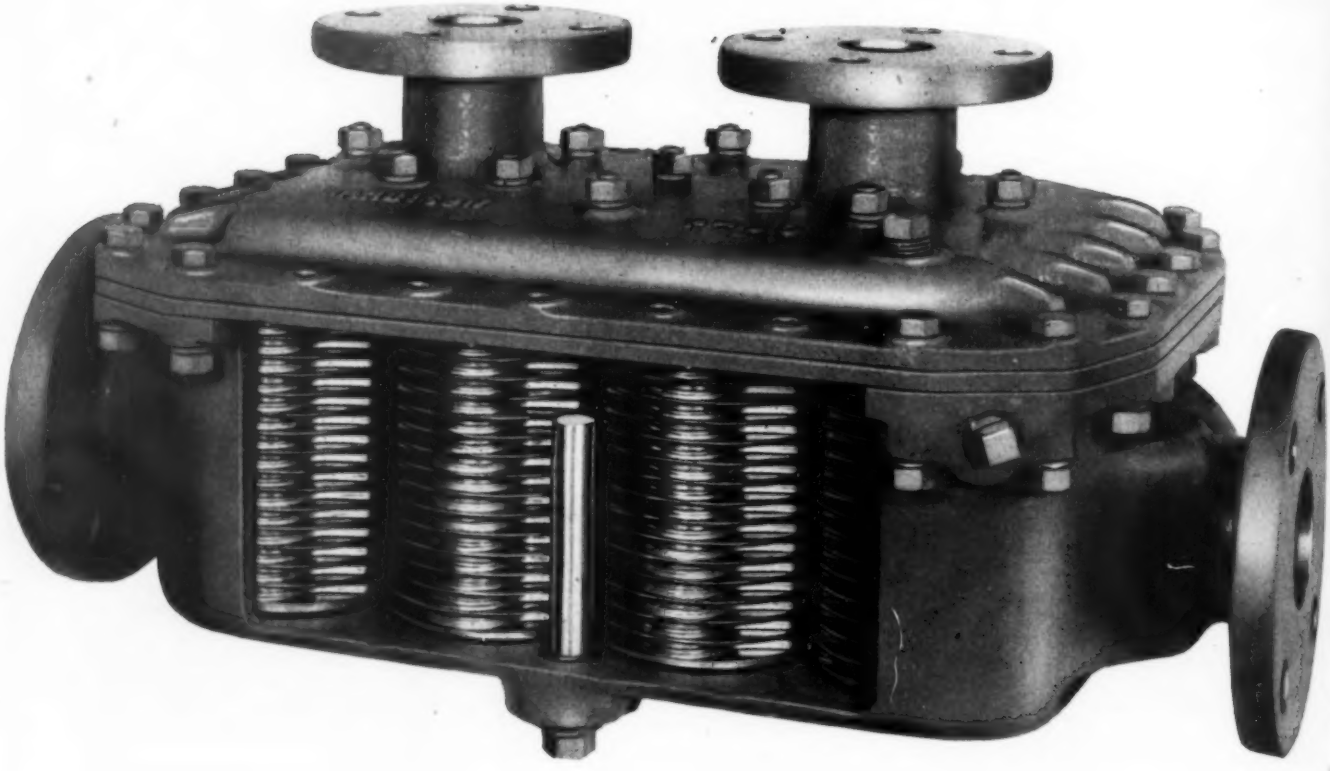
AE Products are: Taylor and Perfect Spread Stokers, Marine Deck Auxiliaries, Hele-Shaw and Hydramite Fluid Power, Lo-Hed Hoists, Lo-Hed Car Pullers.

American Engineering Company
2530 Aramingo Avenue, Philadelphia 25, Pa.

Gentlemen: Kindly send me complete information about the
☐ Hele-Shaw Pump. ☐ Hydramite.

Name.....Title.....
Company.....
Address.....
City.....Zone.....State.....

# HARRISON OIL COOLERS



## keep temperatures down . . . keep production up

Control of oil temperature is an important factor in the efficient operation of hydraulic equipment.

And Harrison oil coolers are engineered to do this job so that production can proceed — in quantity and on schedule.

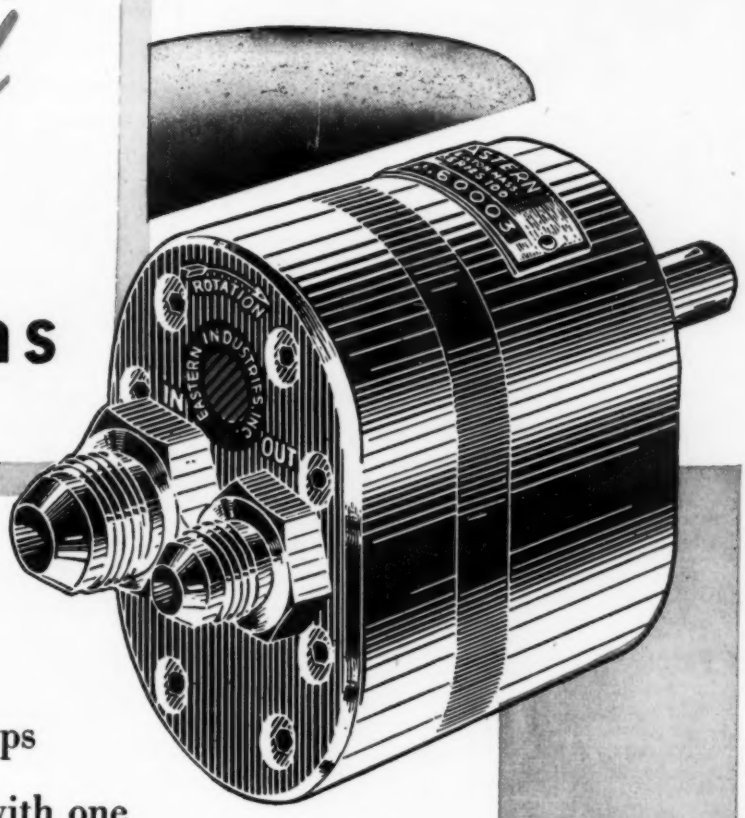
Call on Harrison engineers to recommend the *right* cooler for your equipment.

**HARRISON RADIATOR DIVISION**

GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

HARRISON

# *Designed* for your applications

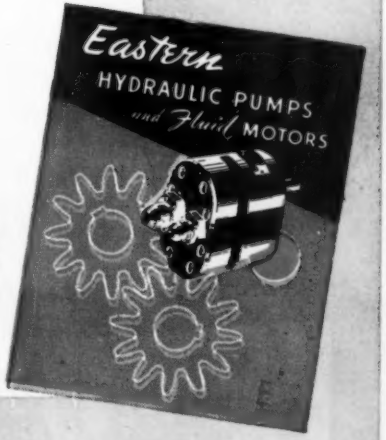



Eastern's line of hydraulic pumps and fluid motors are designed with one objective in mind: *to supply an economical, reliable and compact unit for the heart of your hydraulic mechanism.*

You will find a combination of exclusive features in Eastern products which will make your selection a confident one.

## HYDRAULIC PUMPS FLUID MOTORS

***Send for Eastern's brand new Hydraulic Catalog C-800. Contains valuable engineering diagrams and information.***




**Eastern INDUSTRIES INCORPORATED**

**296 Elm Street, New Haven, Conn.**



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*CIRCLE SEAL*
*CHECK VALVE*
*Manufactured by*
*JAMES-POND-CLARK*
*Pasadena 8, California*

**Parco "O" Rings Insure Positive leak-proofing at high and low Pressure . . .**

This CIRCLE SEAL Valve is required to provide millions of cycles of positive leak-proof sealing at high and low pressures. At the heart of this unique valve are Parco "O" Rings selected by James-Pond-Clark for their toughness and ability to withstand abuse, as well as for their workmanship and finish. Tests and field use prove that Parco "O" Rings are outstanding in their ability to provide PERFORMANCE under any severe service condition. Other Parco rubber products used in industry meet the same high standards of Parco "O" Ring quality. All dash numbers of 6227, 6230 and 6290 series for commercial applications or Army-Navy installations to Specifications MIL-P-5516 (6227 and 6230) and MIL-G-5510 (6290) are available from stock. Silastics and other special compounds are available on order.

*New 8-page catalog and engineering data on request. Write us today.*

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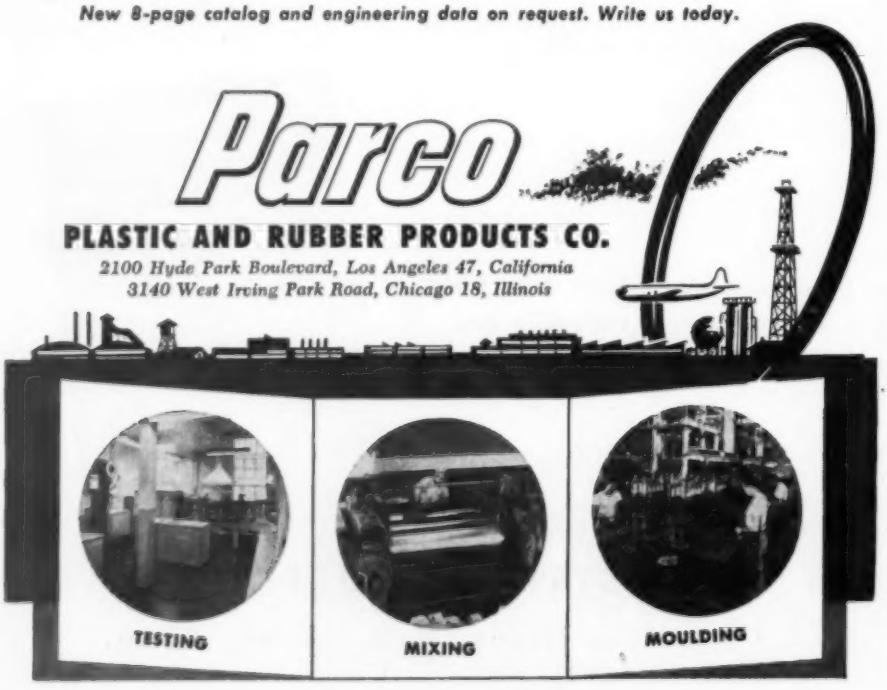




## Letters to the Editor

Continued

time to return the valve plunger from operating position to neutral.

JOHN A. ZSCHIESCHE,
Mechanical Engineer,
Steel and Tubes Div.,
Republic Steel Corp.

*As far as we know no such data has been published by any manufacturer of hydraulic valves. However, it is likely that such information can be furnished by leading valve manufacturers from their own test work or from data compiled for specific applications where such timing is critical. We suggest you start with your own valve suppliers. Another source would be the designers and builders of hydraulic test stands.*

### Honed Tubing

Will you please supply a list of sources who supply honed I.D. tubing.

FRANK I. WEBSTER,
Purchasing Agent,
Gemmer Manufacturing Co.

*From your letter we assume that you are primarily interested in tubing for cylinder barrels. Aside from the few companies that are specialists in small diameter tubing for distribution lines, the companies listed in the* 1953 *Directory issue* (*January*, 1953) *under Tubing, Steel* (*page* 180) *include those who supply honed tubing for commonly used sizes for cylinders.*

### Pressure Drop Through Fittings and Valves

I am particularly interested in the pressure drops through various AN fittings and valves. Design problems would include both compressible and incompressible flow at different flow rates. Any available nomographs or charts would be appreciated.

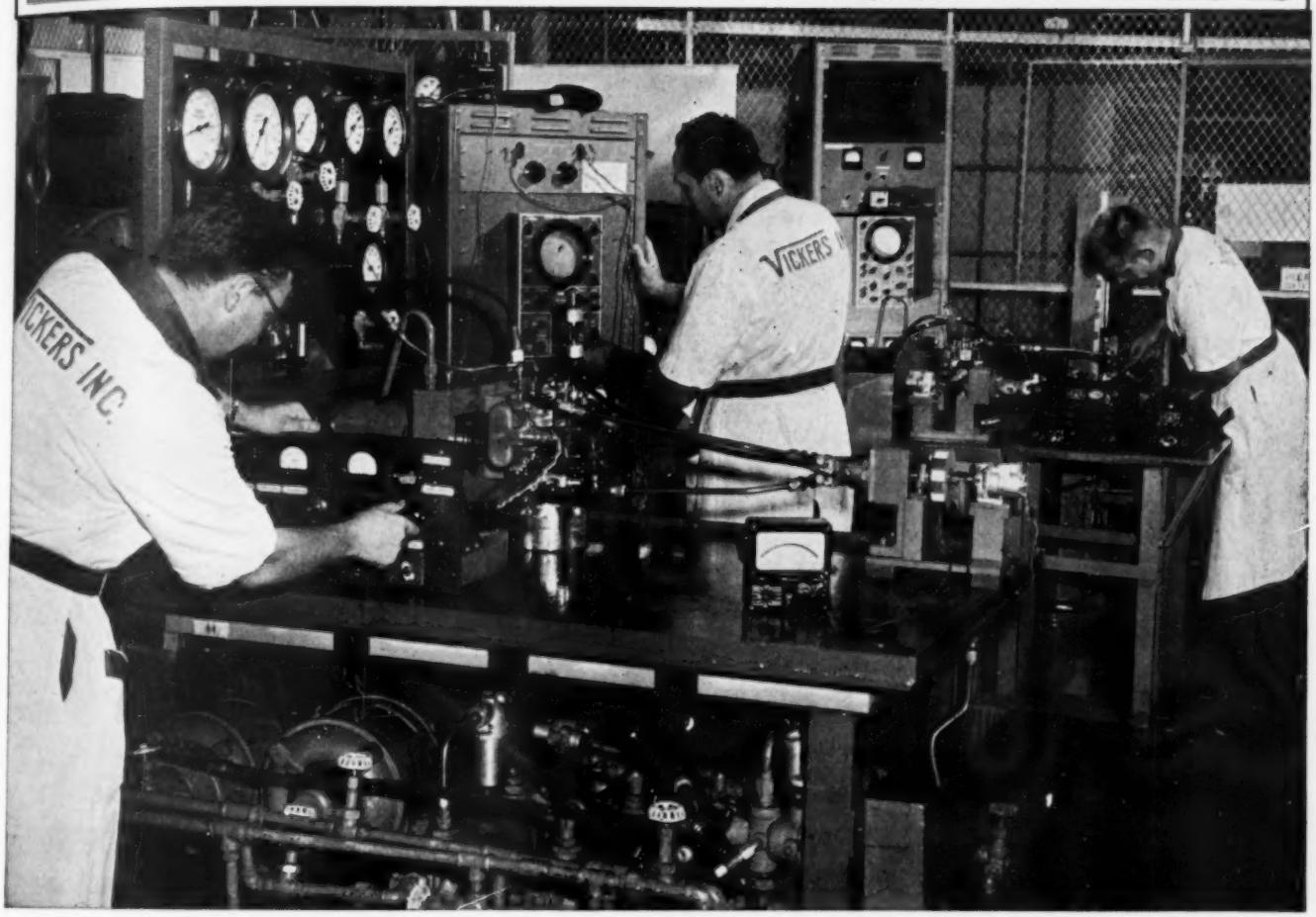
F. W. BOSCH,
Rocket Research Engineer,
Rocket Section,
Bell Aircraft Corporation

*Data on pressure drops through various AN fittings and valves has*

Continued on page 34

ONE OF A SERIES

# You Get Many Benefits by Specifying VICKERS Hydraulics




# Research | that means improved oil hydraulic equipment

The list of pioneering developments in hydraulics contributed by Vickers research is long and impressive. Among the most important are:

Hydrostatic Relief Valve • Commercial Power Steering • Balanced Vane Type Pump • Flow Control Compensator • Axial Piston Pump and Motor

These are fundamental developments that have been of vital importance in the progress of hydraulics. They are representative of a large line of equipment that, with Vickers experienced application, assures you the best in any type of hydraulic operation.

Vickers, with unmatched laboratory and basic research facilities, continues to lead the way in the oil hydraulics industry.

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6357

**ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921**

# *It's too hot in August to read a long story . . .*

**BUT HERE'S A MAJOR POINT TO REMEMBER:**

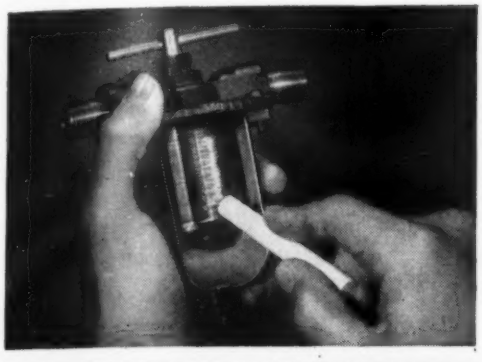
**A choice of five built-in valves in five Bore sizes makes the Bellows air motor the most flexible and easily installed air cylinder made**

*For the detailed story write for Bulletin CL-50*

**The Bellows Co.**
Dept. AH-853
AKRON 9, OHIO

# Here's how this strainer "combs" itself clean!

**This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow**



**ORDINARY BLACKBOARD CHALK** leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.

**TURNING HANDLE ONE REVOLUTION** moves strainer element through comb blades, removing all traces of chalk from between discs. Cuno's exclusive combing operation cleans *thoroughly* —without stopping flow.

**FILTERING AREA IS COMPLETELY CLEAN,** restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.

CUNO

**ENGINEERED FILTRATION**

**Removes More Sizes of Solids From More Kinds of Fluids**

**AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)**

# SINGLE-STRAINER FLUID PROTECTION FOR HYDRAULIC SYSTEMS

**Continuously cleanable AUTO-KLEAN eliminates need for stand-by strainers**

AUTO-KLEAN's compact construction gives users positive solids-from-fluid separation in space which would limit ordinary filters to by-pass service. The low pressure drop operation of AUTO-KLEAN strainers enables you to have full-flow service on gravity, low pressure, high pressure or suction lines—with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides *complete* cleaning of the filter element—without stopping fluid flow. Thus, there's no need for a stand-by strainer.

The low maintenance costs of AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does the cleaning job (most units can be equipped with motor-drives for continuous cleaning).

Fixed-space metal discs in this modern strainer effectively remove all solids larger than the specified disc spacing—from .0035" up to .062".

For permanent, positive hydraulic system protection, install compact Cuno AUTO-KLEAN—the precision-built strainer. Send the coupon for bulletin.

A.3.5

**Cuno Engineering Corporation**
**Dept. 355-A South Vine Street, Meriden, Conn.**

Please send me free bulletin on Cuno AUTO-KLEAN.

Name.....

Company.....

Address.....

City.....Zone....State.....



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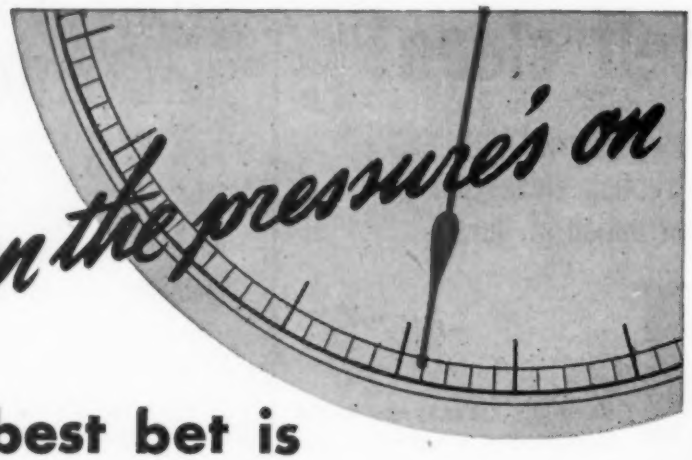


When the pressure's on

your best bet is

FLEX-O-TUBE®

If you use flexible hose in your product or for replacement in your plant, it will pay you to specify Flex-O-Tube. For here is a name that has stood for finest quality and dependable service for more than a quarter of a century.

In the development of new uses for flexible hose, Flex-O-Tube provides you with dependable experience in the field. When used for replacement in industrial maintenance, Flex-O-Tube provides you with a complete range of products that are easy to assemble and long on performance.

Whatever your needs, why not discuss them with the local Flex-O-Tube field engineer. You'll find there are many good reasons why industry has relied on Flex-O-Tube for miles and miles of flexible hose products.

**Supplied in Assemblies**

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

**Supplied for Field Assembly**

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....


## Letters to the Editor

Continued

*not been made available for general distribution. However, the design and testing departments of AN valve manufacturers could very likely give you this information for specific configurations of valves. This is probably true also of the AN fitting manufacturers. At least one manufacturer of aircraft and missile valves includes a pressure drop chart for each model of valve offered. This same manufacturer also lists the capacity of each valve in terms of equivalent orifice diameter. Such data as a regular part of valve specifications could be listed if enough users want such information.*

### Training Programs

We are in the process of expanding our organization (manufacturers' representative in the hydraulic and air field) and we want our new men to get started on the right track. We believe that a quick review such as your "Beginners Course in Basic Hydraulics" and "Beginners Course in Basic Pneumatics" would be particularly valuable for this purpose. Do you have reprints available?

A. L. HACKER,
A. L. Hacker Co.,
Baltimore, Md.

*We did not reprint the Basic Hydraulics. We do plan to reprint the Basic Pneumatics as soon as the series has been completed. We will announce when the reprint booklet is available. Incidentally, we will publish a list of training programs in the October issue. This will be a check list of industry programs, special extension and trade school courses and engineering schools that offer both specific and related courses. With the check list will be a representative 10 period (20 hours) short course outline, based on actual programs now being offered.*

### Automotive Hydraulic Brakes

We would appreciate the name and address of a firm that supplies oil hydraulic brakes to the Ameri-

Continued on page 38

# TIME IS MONEY IN DISCHARGING BULK CARGO

## WHY NOT SEE WHAT A *Hydromotor* CAN DO FOR YOUR PRODUCT OR JOB?

16 Standard Models with ratings from 150 inch-pounds at 100 p.s.i. to 230,000 inch-pounds at 1,000 p.s.i. Additional special sizes with substantially higher ratings are in limited production.

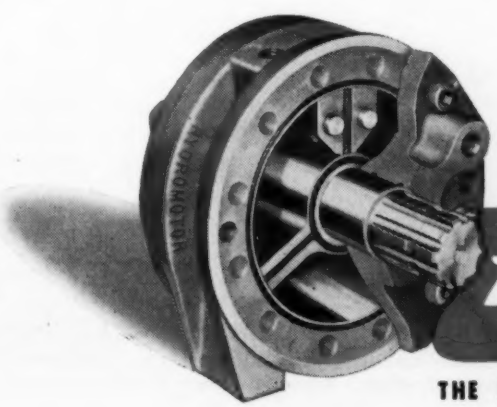
These 60 Bonnot Hydromotors—of 50,000 inch-pounds torque capacity each—are part of 240 recently delivered to one customer.

On bulk carriers, they will replace cumbersome mechanical equipment in the operation of bottom gates on heavy materials hoppers. They'll affect *surprising money savings in unloading time*, and being completely sealed and self-contained they'll *minimize operating and maintenance expense* caused by heavy loads, dampness, dirt and corrosion . . .

**Using any hydraulic medium, the Hydomotor provides reciprocating rotary power . . . develops instant full torque in either direction through any arc up to 280°. With all the flexibility inherent in hydraulics equipment, the Bonnot Hydomotor may be stopped at any point, reversed, speeded up or slowed down by simple controls.**

*For*

LIFTING • LOWERING • PUSHING
PULLING • REVOLVING
SWINGING • OPENING • CLOSING
CLAMPING • TURNING
INDEXING • OSCILLATING
DUMPING • TUMBLING • MIXING
AGITATING • BREECH BLOCKING



**For application and engineering data, write for Hydromotor Bulletin #21.**

**Name of Local Agent on Request**

*Hydromotor* DIVISION

**THE BONNOT COMPANY • CANTON 2, OHIO**

# Hydraulic Diaphragm Sheet Packing by U. S. Rubber

## U. S. Diaphragm Sheet Packing

**Style No. 509** – Recommended for reducing valves and regulators of all types. High-tensile square-woven duck gives structural strength over entire area. Offers maximum resistance to air, water, steam and oil.

## U. S. Oil-Resisting Diaphragm Sheet Packing

**Style No. P-2133** – Impervious to the action of cold oils and gasoline. Made from high-quality medium-weight duck insertion. Cover stock is of a synthetic compound.

## U. S. Supersensitive Diaphragm Sheet Packing

**Style No. 1516-F** – Especially recommended for low-pressure conditions where supersensitiveness is essential or desirable. It has exceptional flexibility and is extremely sensitive and responsive to the slightest change in pressure. The bursting strength across a 2″ circular opening in the 1/32″ thickness is about 45 pounds, and in the 1/16″ thickness about 67 pounds, per square inch. Furnished in rolls of 100 and 200 pounds, 36″ wide, in 1/32″, 1/16″, 3/32″, 1/8″ and 3/16″ thicknesses.

## U. S. Nylon Inserted Diaphragm Sheet Packing

**Style No. P-2339** – Recommended for *high pressures.* Pure gum, nylon-inserted super-sensitive diaphragm sheet. Supplied in 36″ widths in 1/32″, 1/16″, and 1/8″ thicknesses.

UNITED STATES RUBBER COMPANY manufactures a complete line of diaphragm sheets for a wide variety of hydraulic service conditions, such as dry heat, oil, air, water, steam, and general service applications. Send for free charts showing recommended working pressures and diaphragm deflection of the most popular styles. Write to address below. U. S. Packings and engineering service are obtainable at any of the 25 "U. S." District Sales Offices.

***"U. S." Production builds it***
***"U. S." Research perfects it***
***U. S. Industry depends on it***

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**UNITED STATES RUBBER COMPANY**

**MECHANICAL GOODS DIVISION • ROCKEFELLER CENTER, NEW YORK 20, N. Y.**

**Hose • Belting • Expansion Joints • Rubber-to-metal Products • Oil Field Specialties • Plastic Pipe and Fittings • Molded and Extruded Rubber and Plastic Products • Protective Linings and Coatings • Grinding Wheels • Packings • Tapes • Conductive Rubber • Adhesives • Roll Coverings • Mats and Matting**

# Turchan has what industry needs in the trend to Automation

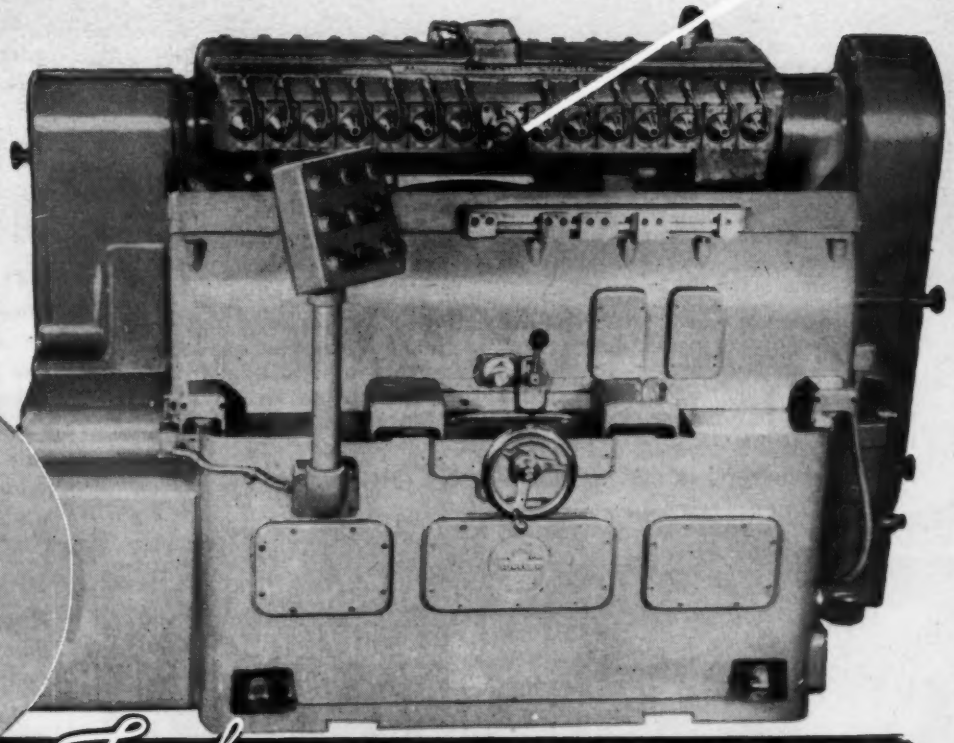
tracer-controlled
multiple spindle machine
automatically mills
14 jet engine compressor
blades simultaneously

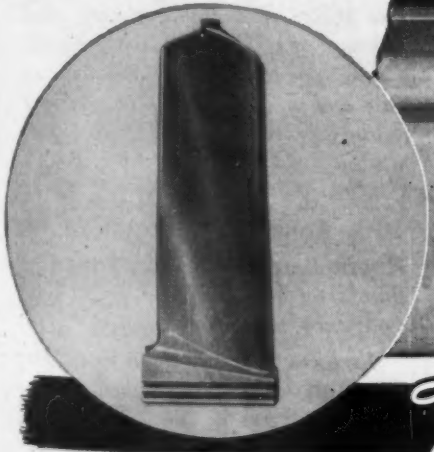
## MILLING ACHIEVEMENT!

Extensive research into turbine blade production by leading aircraft designers resulted in this 14-spindle duplicator. Manufactured by Modern Tool Works, Ltd., it's an outstanding example of how Turchan tracer-controls are fitting into management's plans for automation of standard and special machines. Production time and cost per unit are slashed to a minimum, highly skilled manpower shortages are eliminated.

Tracing from a master the desired contour is machined by hydraulic control on 14 blades to accuracies and finishes that reduce final operations to a minimum.

*Also tracer valves, cylinders, power units specially designed.*





Turchan FOLLOWER MACHINE CO.

8259 Livernois Avenue • Detroit 4, Michigan

# Here is the solution to "O"-Ring Packing Problems...

This new Catalog—No. OB-1152—tells the story of the Hydraulic "Packing Package" that offers one source of supply and undivided responsibility for "O" Rings and their companion Back-up Rings for all military and commercial requirements.

**Chemiseal "O" Rings** of resilient, homogeneous synthetic rubber—absolutely non-porous and withstanding the required wide temperature ranges.

**Chem-o-green Back-up Rings** of chemically inert duPont Teflon*, colored green for identification. Made in three types—solid, split and the popular spiral type, preferred by most engineers.

Advantages are many. Chemical inspections may be eliminated as Teflon is non-corrosive. Zero swelling in all hydro-carbons and newer synthetic hydraulic fluids. Service temperatures from −110°F. to + 500°F. Unsurpassed anti-friction properties. Water proof. Non-flammable. Long wearing. Requires no water soak for installation.

Ask for your copy of this new Catalog No. OB-1152.

*duPont Trademark

**UNITED STATES GASKET COMPANY**

FLUOROCARBON PRODUCTS DIVISION
CAMDEN 1, NEW JERSEY

Representatives in Principal Cities Throughout the World


## Letters to the Editor

Continued

can automotive market. We are interested in the possible licensing of an American firm to build and sell such equipment under our patents.

ALBERT LICHTE, VDI,
Randerath, Heerweg 164,
Germany

*The Industrial Products Division, Westinghouse Air Brake Company, Wilmerding, Pa.; Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo. and Bendix Aviation Corporation, address Bendix International, 72 Fifth Ave., New York 11, N. Y., are leading manufacturers and suppliers of oil hydraulic brakes to the automotive industry. We understand that the Automotive Products Ltd., Teachbrook Road, Leamington Spa., England, also furnishes a similar line of equipment.*

---

### 6000 psi Air Valves

We note with interest an inquiry from one of your readers regarding a 6000 psi air valve (April issue, page 20). We have been developing all types of valves for the past seven years, one of which is a 6000 psi air valve. We are enclosing an installation drawing covering this valve. We would appreciate it if you would forward this to Mr. J. H. Millar of Engineering Development, Inc.

R. HAMEL,
Secretary,
Marotta Valve Corporation

*Thanks, Mr. Hamel. The installation drawing of your 6000 psi air valve has been forwarded to Mr. Millar. We are also very glad to know of this valve, since requests of this type come to us from time to time and we always like to give our readers prompt and accurate information.*

---

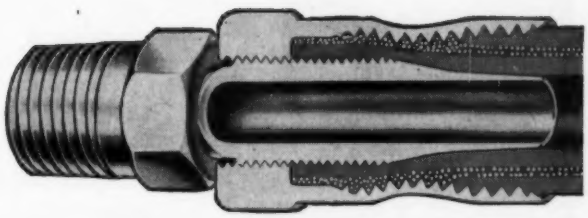
### Nonflammable Water Based Emulsion for High Temperature area

We have an application in which, due to the proximity of steel billets heated to 2200 F., we do not wish to use standard inflammable hy-

Continued on page 42

# CUT DOWNTIME!

## Stock WEATHERHEAD Heavy-Duty Hose and Reusable Couplings



**TIMESAVING, ON-THE-SPOT REPAIRS** are easy when you carry your own stock of Weatherhead Reusable Couplings and Heavy-Duty Hose. Weatherhead Catalog H-1451 gives you all the details. Get your copy by writing THE WEATHERHEAD COMPANY, Dept. A, 300 East 131st Street, Cleveland 8, Ohio.

- Five Types of Heavy-Duty Hose . . . To Meet Every Pressure Requirement
- Reusable Couplings . . . Best by Test
- Positively Leakproof . . . Maximum Flow
- Rugged Construction . . . More Gripping Area
- Easy to Assemble with Common Bench Tools
- Long Service Life . . . Use 'Em Over and Over Again

The Mark of Quality

WEATHERHEAD

FIRST IN HYDRAULIC CONNECTIONS

# DENISON HydrOILics

## . . . for longer-lasting efficiency

# PUMPS, MOTORS and CONTROLS

"The Finest Money Can Buy!"

**Denison Axial Piston Pumps.**
Hydraulically balanced, high-pressure, high-volume pumps in a range of sizes for circuits of 3000 and 5000 psi capacity . . . volume capacities 3.5 to 35 gpm. Constant volume, or variable volume with control by hand wheel, pressure compensation, stem, or cylinder. Face, flange or foot mountings. Catalogs P-4-1, P-4-2, P-4-3, P-4-10.

**Multi-Range Flow Controls**
permit full-scale regulation of flow for many different circuit needs, at pressures to 3000 psi. Infinitely adjustable within each range of control . . . cartridge-type single-spool design adjusts easily to various pump deliveries without changing spools. 2-port and 3-port types, with or without built-in check. ¼", ⅜" and ¾" sizes; 0 to 28 gpm capacities.

**Pilot-Operated 4-Way Valves**
—with solenoid control—for circuit pressures to 5000 psi. Eliminate spool-sticking during long high-pressure holding cycles. System pressure shifts valve spool; solenoid operates valving only. Catalog VD-1-1.

For more than 25 years, Denison has been meeting Industry's toughest demands for oil-hydraulic equipment—with efficient high-pressure components that have won wide approval for their rugged, compact design and long, low-cost performance.

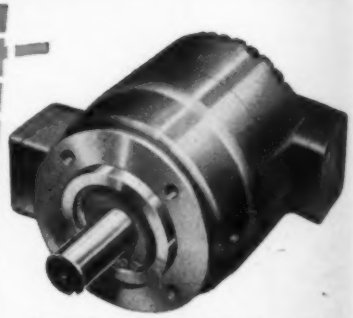
To meet constantly increasing needs, Denison now offers *today's most rapidly expanding line* of equipment for packaged hydraulic power, hydraulic transmissions, remotely controlled equipment, and other requirements for widely adjustable power, speed and control. A few of these HydrOILic components are shown here.

To make sure you get the fullest advantages of oil hydraulics—for variable-speed drives, accurate pressure control, spark-free power transmission, or closely controlled motion of any kind—specify Denison's HydrOILic Equipment.

Write for further details or call your Denison representative today.

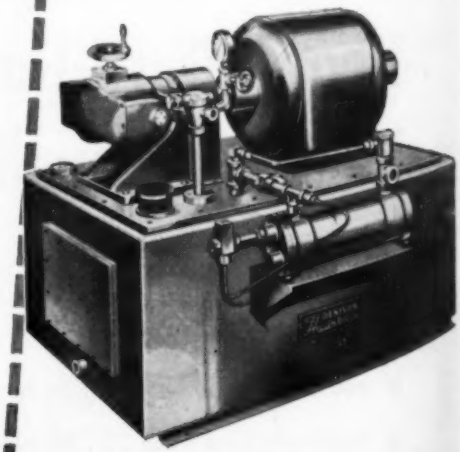
**The DENISON Engineering Co.**
**1166 Dublin Rd., Columbus 16, Ohio**

DENISON HydrOILics



**Vane-Type Single-Stage Pump/Motors,**
built for continuous use at pressures to 2000 psi, are ready for either pump or fluid motor duty without alterations. Rotation of shaft can be either direction without internal adjustment. Four sizes, plus interchangeable cam rings, offer pumping capacities from 2½ to 70 gpm, or torque ratings from 13 to 257 inch-pounds per 100 psi. Catalog P-5.

**Denison Axial Piston Fluid Motors.**
Four sizes, with torque capacities ranging from 510 to 5585 inch-pounds (about 24 to 160 HP). Speeds to 2000 and 3000 rpm. Compactly built . . . largest size is only about one foot in diameter. For circuits of 2500 and 5000 psi. Catalogs FM-2 and FM-3.



**Denison's Self-Contained Pumping Units.**
37 models cover any circuit need from 400 to 5000 psi and from 2 to 35 gpm requirements. Automatic water-cooled oil coolers or two-pass automatic heat exchangers available for extra heavy or continuous service. All operating components mounted on reservoir top in single-panel assembly, for easy removal as a unit. Catalogs PU3 and PU4.

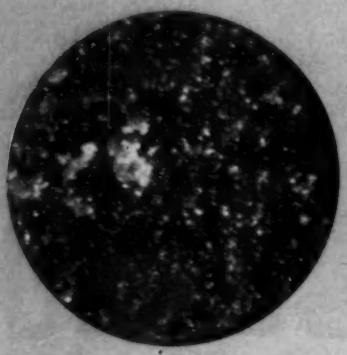
# NEW PHOTOMICROGRAPHS SAY IT BETTER THAN WORDS

this is why

## HOUGHTON VIX-SYN PACKINGS

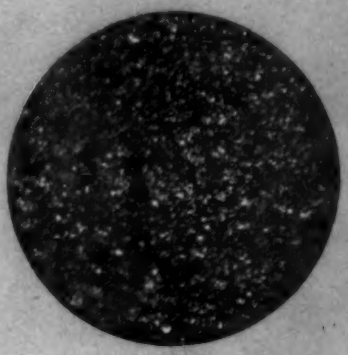
give you better service

**Cross-section of average compound**



*Coarser, less dense pattern of rubber* is indicated in this photomicrograph of a standard packing compound, magnified 240 diameters. Visual evidence that pliability and wearing qualities are only fair.

**Cross-section of Vix-Syn compound**



*Fine-grain density of rubber throughout Houghton Vix-Syn Packing* is shown in this cross-section similarly magnified. This compact, homogeneous quality means superior flexibility and assures long, hard service.

As you've seen in the magnified photos above, our special molding process produces a full fine-grained texture of synthetic rubber *throughout the packing.*

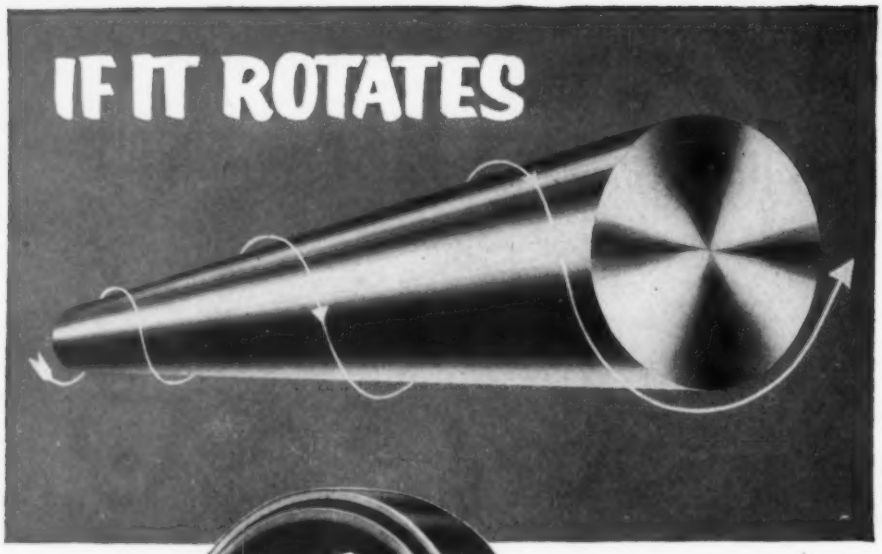
This homogeneous compound of synthetic rubber promises you a number of outstanding advantages. Its exceptional pliability, for example, makes installation easy and a tighter seal possible in all hydraulic applications. Its resistance to heat, oils and solvents prolongs the life of the packing. Efficient operation is assured under a wide range of pressures up to 15,000 psi.

Houghton Vix-Syn Synthetic Rubber Packings are available in "V's", "U"-cups, gaskets and "O" rings. Vim leather back-up washers specifically designed for use with "O" rings, and fabricated rubber packings, are also supplied. Ask your Houghton Man for latest bulletin, or write to E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

**VIM and VIX-SYN PACKINGS**
**. . . products of**

**E. F. HOUGHTON & CO.**
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

***Ready to give you on-the-job service . . .***



SEALOL can seal it!

Pumps, fluid transfers, flexible joints, hydraulic motors, hydraulic actuating devices . . . these and countless other products depend on Sealol for their maintenance-free performance. Sealol Balanced Pressure Seals are usually one of the smallest components in the equipment they serve . . . yet what a difference Sealol Seals make in operating efficiency!

Sealol Seals are handling pressures up to 1500 psi, rubbing speeds to 15,000 FPM, operating temperatures to 500° F. The Sealol *balanced pressure principle* insures close control of face pressure at the point of sealing — resulting in low friction, low torque, minimum heat, and low power loss. Sealol performance improves product performance . . . and reduces product maintenance.

Let's talk it over. Send for NEW Bulletin 7 giving complete details on Sealol Balanced Pressure Seals — or write giving details on your problem for engineering recommendations. Sealol Corporation, 9 Willard Avenue, Providence 5, R. I.

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SEALOL

THE ▲ BALANCED PRESSURE SEAL


## Letters to the Editor

Continued

draulic oils. The loads are so low that we can use air for all functions except a hoist cylinder, in which we desire to use a fluid medium in order to obtain smooth and uniform motion easily controlled and we like to use air-over-fluid as a source of power for this cylinder. We would like to have the names and addresses of any possible sources of supply of any compounds that would form a nonflammable water based emulsion having better lubricating qualities and less corrosive effect than water; failing that, any sources of supply of a nonflammable hydraulic fluid which is not excessively costly.

W. Fenton Meredith,
Chief Draftsman,
Magnethermic Corp.

*Your choice of an air-over-fluid type cylinder for your hoist probably is a good one. You have already checked with one or more manufacturers of boosters or oil controlled -air power cylinders. Check lists of these manufacturers are being sent to you. More information on your application would need to be known to determine whether a water base emulsion or a nonflammable hydraulic fluid would be preferable. Your regular oil suppliers could advise you. The nonflammable hydraulic fluids average approximately $2.50 per gallon in small lots. With a well designed cylinder that assured a low leakage rate and the considerably longer life, the nonflammable hydraulic fluids can be considered sound in terms of cost.*

### Electronically Controlled Hydraulic Valve

Do you know who makes an electronically controlled hydraulic valve that will control the flow directly with the variation of an electric current? I understand that there is such a valve worked with triodes.

Harry D. MacRae
Rochester 9, N. Y.

*According to our information, the following companies could give you further information regarding*

Continued on page 44



Circle 91 on Reader Service Card

Circle 93 on Reader Service Card

# Announcing

## Snap-tite's Hi-Flow LINE

FULL SWIVEL

# QUICK CONNECT and DISCONNECT COUPLERS

Long Life

lve Both Ends
Valve One End
or Plain

and Low
ressure

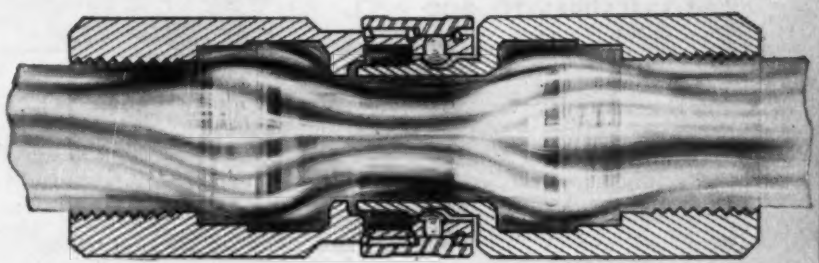
Made in Sizes 1/8" - 1/4"
3/8" - 1/2" - 3/4" - 1" - 1 1/4"
1 1/2" - 2" - 2 1/2" - 3" - 4"
6" - 8" - AND UP

For Air • Water • Oil
Gas • Chemicals
Steam, Etc.

Made from Steel
Brass • Aluminum
Stainless Steel

The Hi-Flow Line Is
Lighter in Weight

*The Greatest Flow in Couplers . .*



Certain territories in the United States and foreign countries available for aggressive manufacturers representatives. Write for details.

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Riggs Engineering Co.
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Product Maintenance Co.
3344 West 105th Street
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P. T. Standard Parts Co.
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Pontiac 16, Michigan

Walter N. Prokop
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Chicago 51, Illinois

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St. Louis 4, Missouri

R. V. Distributors
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Portland, Oregon

W. E. Layman
164 E. Exchange Street
Akron 4, Ohio

W. E. Fry & Co.
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L. W. Rapkin Supply Co.
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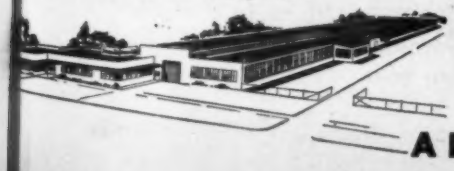
Geo. A. Kushman Company
95 Market Street
Oakland 4, California

ur factory is devoted exclusively to
e manufacture of Snap-Tite quick
connect-disconnect couplers.



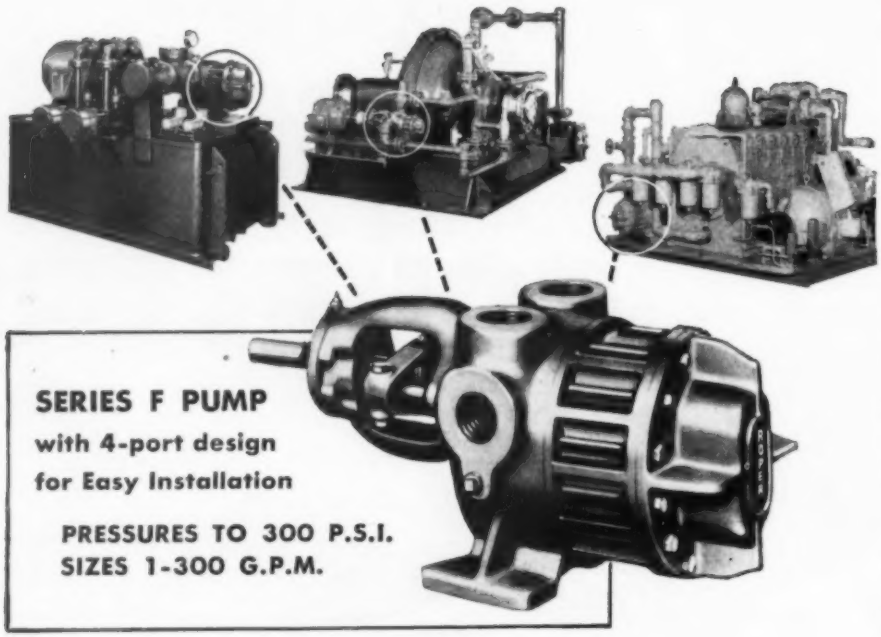
SEND FOR NEW
TECHNICAL CATALOG NO. VP 83

## SNAP-TITE, INC.

ARMAND AVE., UNION CITY, PA.

**ROPER** *Rotary Pumps* **POWER** *That's Dependable*

# POSITIVE CONTROL *for Hydraulic Circuits*



**SERIES F PUMP**
**with 4-port design**
**for Easy Installation**

**PRESSURES TO 300 P.S.I.**
**SIZES 1-300 G.P.M.**

Whether you are planning one special machine or hundreds on a production run, consider putting a Roper on the job. Consider 4-port design of the Series F (eight optional piping arrangements — 4 for CW and 4 for CCW rotation) for ease of installation and servicing. Consider, too, the Roper principle of only two moving parts . . . equal size gears operating in axial hydraulic balance . . . standard or stainless steel fitted models, as desired . . . heavy duty flange type bearings. Pumps are supplied with or without relief valve . . . with packed box or mechanical seal. Yes . . . consider Roper for *your* hydraulic applications.

**Send for Your Free Copy of New Roper Fact-Packed Booklet!**

A valuable 36 page guide that includes tables, charts, and other data relative to the average pumping job. Send for your free copy . . . use coupon below.

**Geo. D. Roper Corporation**
**708 Blackhawk Park Ave.**
**Rockford, Illinois**

Please send copy of your latest catalog and new booklet "How To Solve Pumping Problems".

NAME.....

ADDRESS.....

CITY.....STATE.....


## Letters to the Editor

Continued

*electronically controlled hydraulic valves that would control flow directly with the variation of an electric current: Marotta Valve Company, Division of the Bridgeport Thermostat Div., Robertshaw-Fulton Controls Company, Boonton, N. J.; Eclipse-Pioneer Division Bendix Aviation Corporation, Teterboro, N. J.; and Servomechanisms, Inc., Westport, L. I., N. Y.*

### Compressed Air Handbook

Could you tell me where I could obtain a copy of "Compressed Air Handbook"? Will you give me the address of the Compressed Air and Gas Institute?

R. M. SCHMIDT,
Fort Worth, Texas

*The Compressed Air Handbook is published by the Compressed Air and Gas Institute, 1410 Terminal Tower Bldg., Cleveland, Ohio. The current edition is exhausted but a new edition, considerably enlarged, will be ready for distribution in October. We will make an announcement in APPLIED HYDRAULICS when the new edition is available.*

### High Torque Wrench

We are trying to locate some reliable manufacturer of hydraulic tools who can give us a small unit to be used as a wrench. This tool will be on a line with 1200 psi working pressure and we want to get 200 foot pounds pressure on a ¾ inch nut. What we would like, if we could find such a tool, is to put a relief valve on the clutch arrangement to cut off at the right pressure. If possible, the tool should be small enough to be hand operated.

ALFRED E. PICKARD
Central Mine Supply Co.

*You have asked a tough one. We understand 1000 inch pounds is about what can be developed with a 15 inch Crescent wrench, using a 6 foot pipe and a scale. Most snap-on tools available are limited to about 600-700 inch pounds. Greenlee Brothers & Company, 2100 12th St., Rockford, Ill. make a number of hydraulic tools and may be able to help you.*

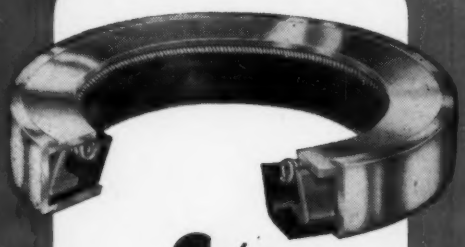



Circle 89 on Reader Service Card

Circle 21 on Reader Service Card

# When correct design and dependable performance are especially important

***you can depend on Chicago Rawhide for reliable solutions to your mechanical sealing and protection problems***



## C/R Oil Seals

The "Perfect" answer to fluid retention, moisture and foreign matter exclusion, and similar mechanism protection problems. Used more than any similar device in motor vehicles, industrial machines, farm implements, and road machinery. Stocked in over 1800 sizes, covering 16 different types.

**Write for "Engineering with C/R Oil Seals"**

## sirvis

**MECHANICAL LEATHER PRODUCTS**

Actual tests prove Sirvis packings require less replacement than any other type. Made in a complete line of cup, flange, U and V types from specially treated and tanned steerhide. Available in special designs, scientifically engineered to solve unusual situations.

**Write for Sirvis Mechanical Leather Catalog**

## SIRVENE

**SCIENTIFICALLY COMPOUNDED ELASTOMERS**

**(Synthetic Rubber)**

When you need an oil-resistant, pliable part with an exact degree of flexibility, hardness, resistance to extreme temperatures, fluids, gases, abrasion and wear . . . whether it be an intricately designed diaphragm or boot . . . or a simple but critical packing or gasket . . . Sirvene will serve you dependably.

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SIRVENE 1878 75 1953 C/R FIFTH ANNIVERSARY

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*Representatives in these Principal Cities*

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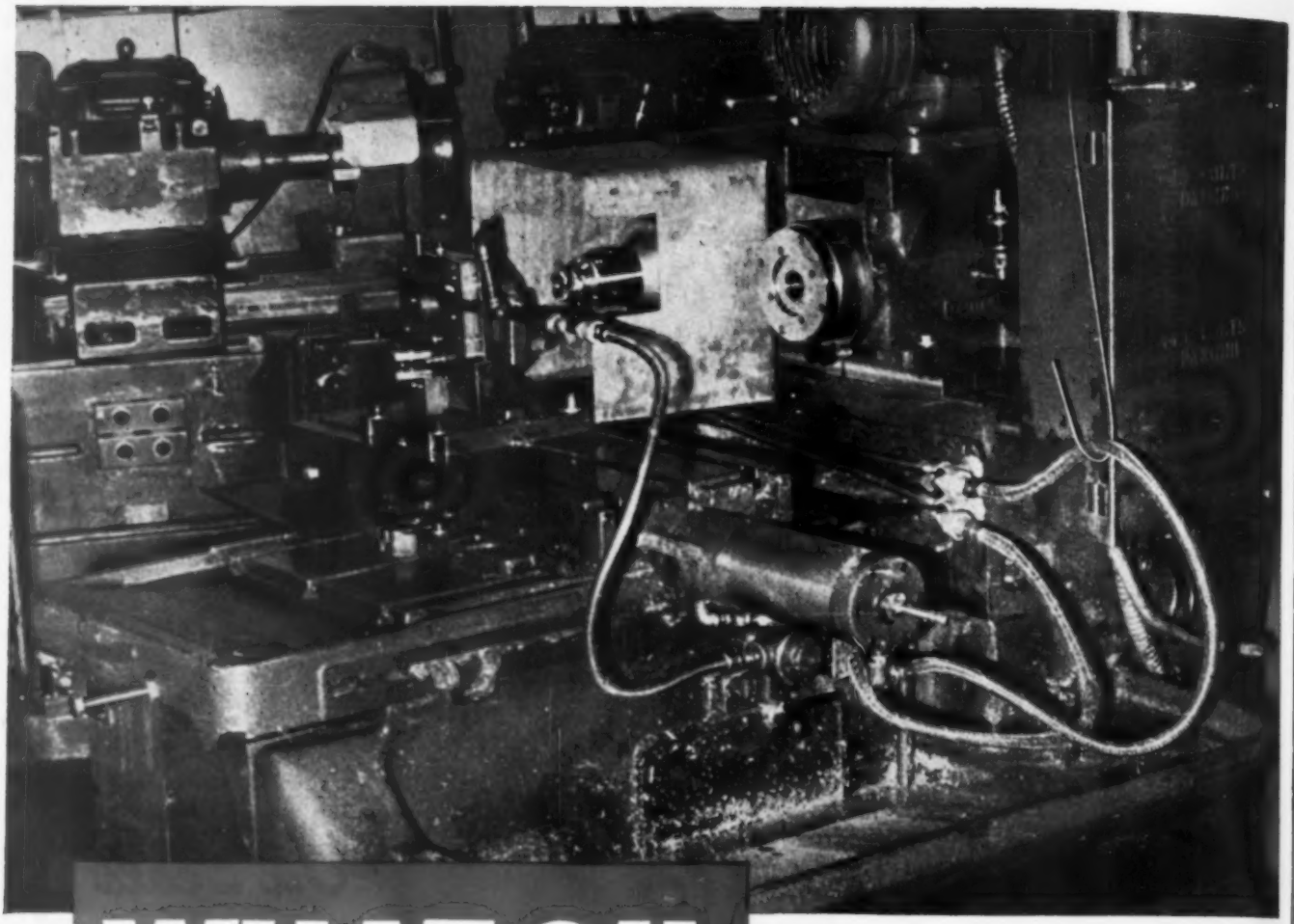


# WHAT OIL IS BEST... for YOUR hydraulic system?..

**YOU SHOULD USE** an oil that will keep the system free from sludge, rust and foam — *Texaco Regal Oil (R&O)*. This is the oil that tests prove has *more than ten times the oxidation-resistance* of ordinary turbine-quality hydraulic oil . . . far greater effectiveness in preventing sludge, rust and foam.

No matter how severe the service, *Texaco Regal Oil (R&O)* keeps hydraulic mechanisms running smoothly . . . protects against wear . . . increases pump and valve life . . . cuts maintenance costs. There is a complete line of *Texaco Regal Oils (R&O)* approved by leading hydraulic manufacturers.

*Before replacing any hydraulic oil with Texaco Regal Oil (R&O), first clean the system with Texaco Flushing Oil (R&O). This will remove loose rust, sludge and other material, and permit the Texaco Regal Oil (R&O) to function at its full efficiency throughout its years of life.*

A Texaco Lubrication Engineer will gladly give you full details. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N.Y.

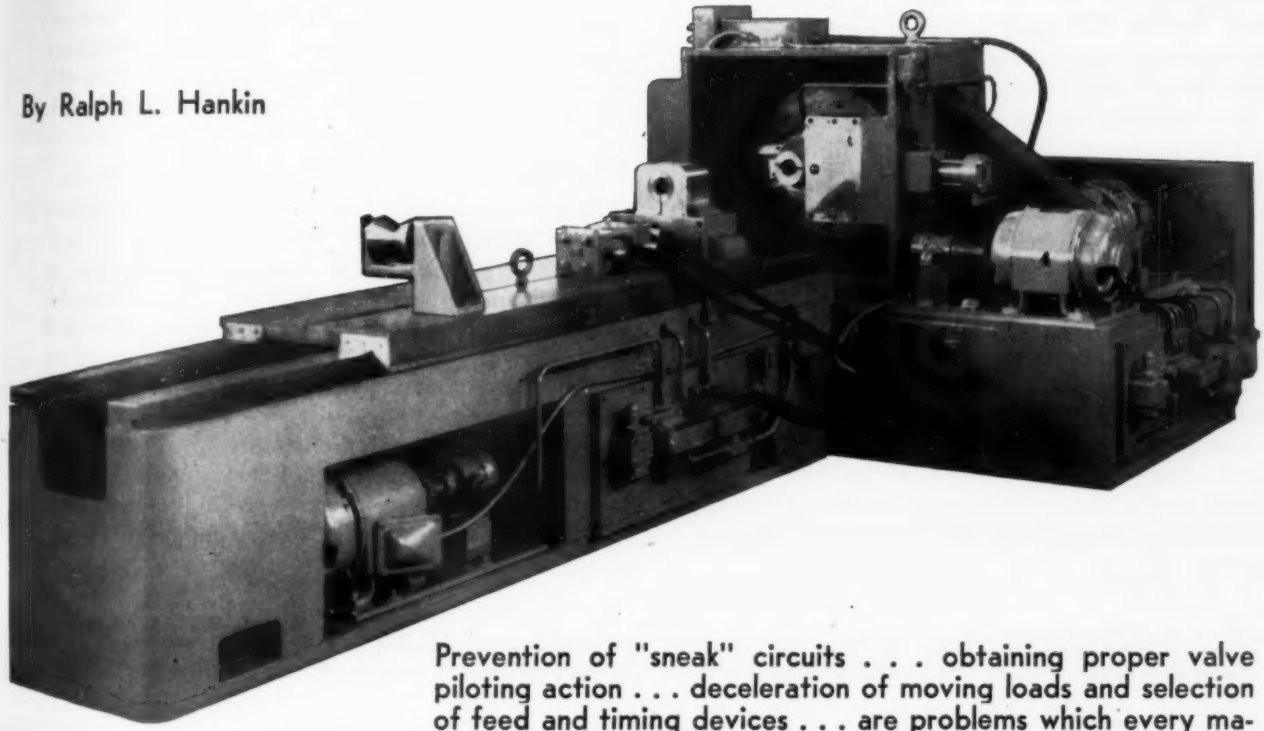
TEXACO

**TEXACO Regal Oils (R & O)**

**FOR ALL HYDRAULIC UNITS**

# CONTROL CIRCUITS
## for Feed—Clamp—Work Cycle

By Ralph L. Hankin



**Prevention of "sneak" circuits . . . obtaining proper valve piloting action . . . deceleration of moving loads and selection of feed and timing devices . . . are problems which every machine designer must solve. The hydraulic and electrical controls for the feed, clamp and cut-off circuits described in this article are the basic elements of the design of many similar circuits.**

TWO separate complete hydraulic systems power the tube feed and the cutting tools as well as the necessary clamping fixtures on this tube cut-off machine. The electrical control circuit is arranged to permit independent manual operation of each circuit or completely automatic operation with both hydraulic circuits tied together electrically. Except for the electrical connections the feed table and cut-off head are independent units. Each unit has its own hydraulic reservoir, pump and drive motor.

Use of individual hydraulic circuits, greatly simplifies piping and valving, keeps the design compact and assures positive action.

*RALPH L. HANKIN, Chief Engineer, The Etna Machine Co., Toledo, Ohio.*

Designed and built by The Etna Machine Company of Toledo, the tube cut-off machine will handle diameters up to 5-¾ inches and wall thicknesses up to 5/8 inch. On this machine, the tube remains stationary and the cutter head rotates as tubing in lengths from .125 to 48 inches is cut with less than .005 of an inch variation. The tube is cut off by means of two parting tools, leaving a lathe type cut, accurate and square with a minimum burr.

Briefly, here is the sequence of operation. Adjustment of a positive stop on the feed table is made to give the desired tube length. A length of tube is clamped in the jaws of the feed table and the feed table moves forward to a fixed stop, feeding the tubing into position to be cut off. The cut-off jaws clamp the tube while cutting tools rapidly advance up the

## Control Circuits

tubing. The cutting tools then feed in at a preset rate to cut off the tube.

While the cut is being made, the feed table clamps open and the feed table returns to its starting position and reclamps the tube. When the tubing is cut off, the tools retract, the clamping jaws on the cut-off machine open and the feed table can now be moved forward to feed a new length of tube into position.

### Feed Table Circuit

All valves on the machine are panel mounted units to provide a rigid compact hydraulic assembly. On the feed table, two closed center, four-way pilot operated solenoid controlled valves direct oil to the tube clamp cylinder and table feed cylinder. The 50 inch stroke feed cylinder is cushioned in the blank end only. The end of the feed stroke is always against this cushioned stop. To be sure that oil pressure is available to the clamp cylinder before oil can go to the table feed cylinder, a sequence valve, set at a pressure lower than the 200 psi relief setting, is in the circuit.

Changing the length of tube to be cut is accomplished by limiting the cylinder stroke by use of adjustable positive stops as shown in the circuit diagram.

On the return stroke of the table, oil in the rod end of the cylinder flows freely back to tank through the deceleration valve and four-way valve. As the feed table returns to its original starting position and approaches the positive stop, a cam contacts the decelerating valve which gradually shuts off the free flowing oil from the rod end of the feed cylinder back to tank. The table decelerates and continues to move at a reduced speed until the positive stop is contacted. The reduced speed is regulated by the needle valve which meters the flow which is allowed to by-pass the deceleration valve.

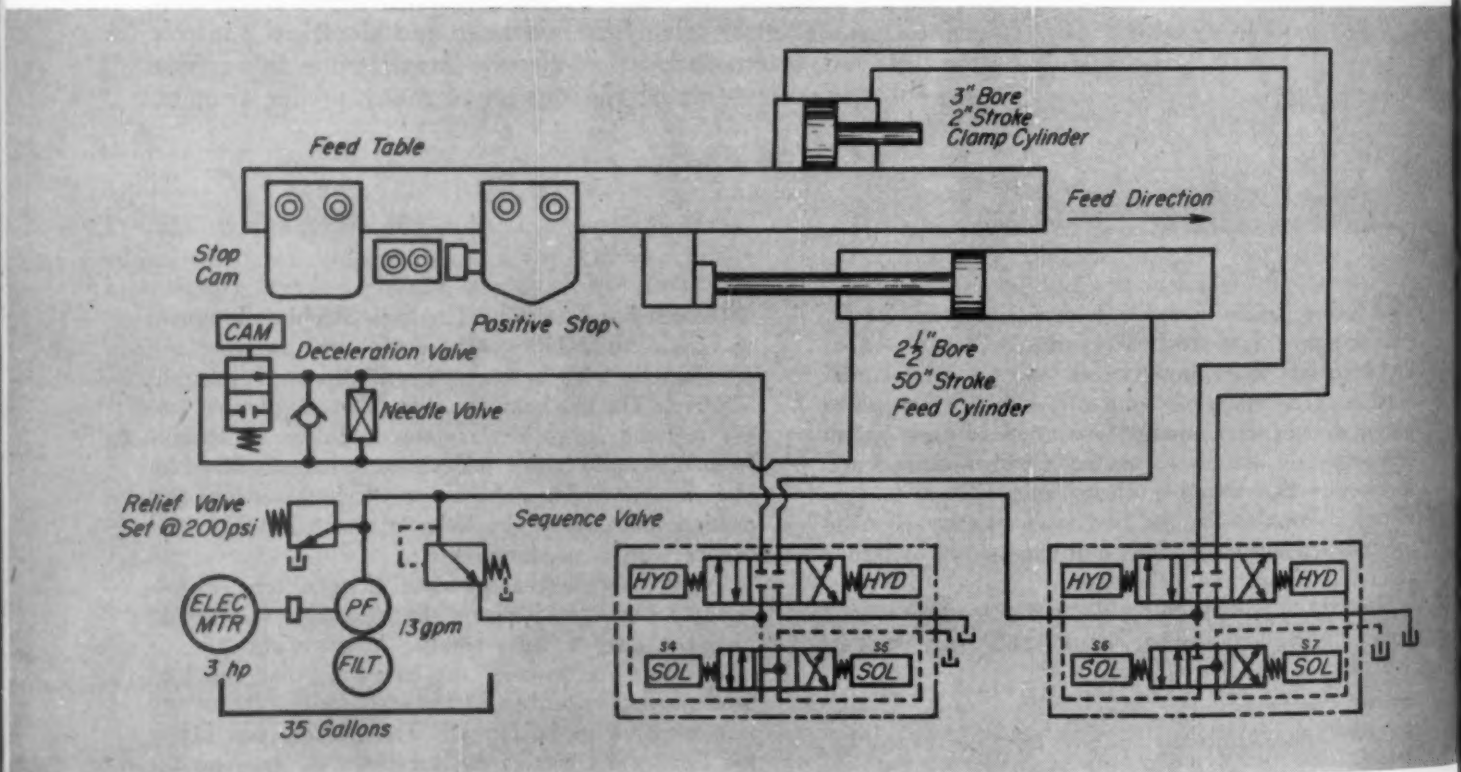
With the 13 gpm pump delivering its volume to the rod end of the tube feed cylinder, the tube is fed to the cut-off head at 75 fpm. Here is a design where the cylinder is arranged to return at a speed which is slower than forward speed because the cutting tools are working while the feed table returns and then the tools are idle while the table brings the work forward.

### Tool Cut-off Circuit

The spindle design, shown in the accompanying cross-section photograph includes the two tool feeding cylinders. The cutting tools are rigidly held in hardened and ground tool holders and are individually adjustable to suit the various diameters and wall thicknesses of tubing to be cut. Two inch movement of the hydraulic cylinders causes ¾ inch tool movement by action of tapered cams which are clearly shown in the cross-section photo.

Total tool stroke of ¾ inch remains constant; however, the rapid traverse portion of this tool stroke is readily adjustable by turning a hand control dial which

**FEED TABLE CIRCUIT has a feed cylinder which is cushioned on the blank end. A deceleration valve slows the return stroke. Positioning of the positive stops permits changing of the tube length being cut.**



changes the point at which a limit switch is tripped to change to a pre-selected tool feed rate. The rapid traverse feature enables the operator to combine the maximum tool life with the minimum cutting cycle time when cutting heavy wall or light wall tubing, and also allows the tools to amply clear the next tube being fed through the spindle.

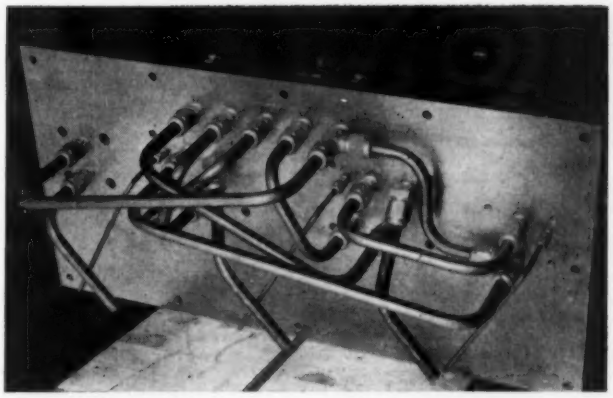
### Spindle Drive

A bronze seal maintained by spring pressure protects the hydraulically actuated tool slide from coolant and chips. Rigidly mounted on tapered roller bearings, the tool spindle is driven through V-belts by means of a variable speed 7½ hp DC motor. The machine is designed for up to 20 horsepower.

An adjustable metering out valve on the tool feed cylinders controls the cutting feed rate.

One of the interesting design problems which came up on the tool feed circuit involved the use of the external pilot line to the shut-off valve which cuts the metering valve in or out of the circuit. It was found that using internal pilot operation was too sluggish and the tools would advance almost ¼ inch before the valve would shut off and throw in the feed. This meant that the maximum feed stroke could only be ½ inch. By using an external pilot to the shut off valve, closing time was fast enough to permit a maximum of 11/16 inch of feed—only 1/16 inch of total travel is in rapid travel.

Sequence valves in the circuit assure clamping of the tube before the tools feed in and then retraction of the tools before unclamping.

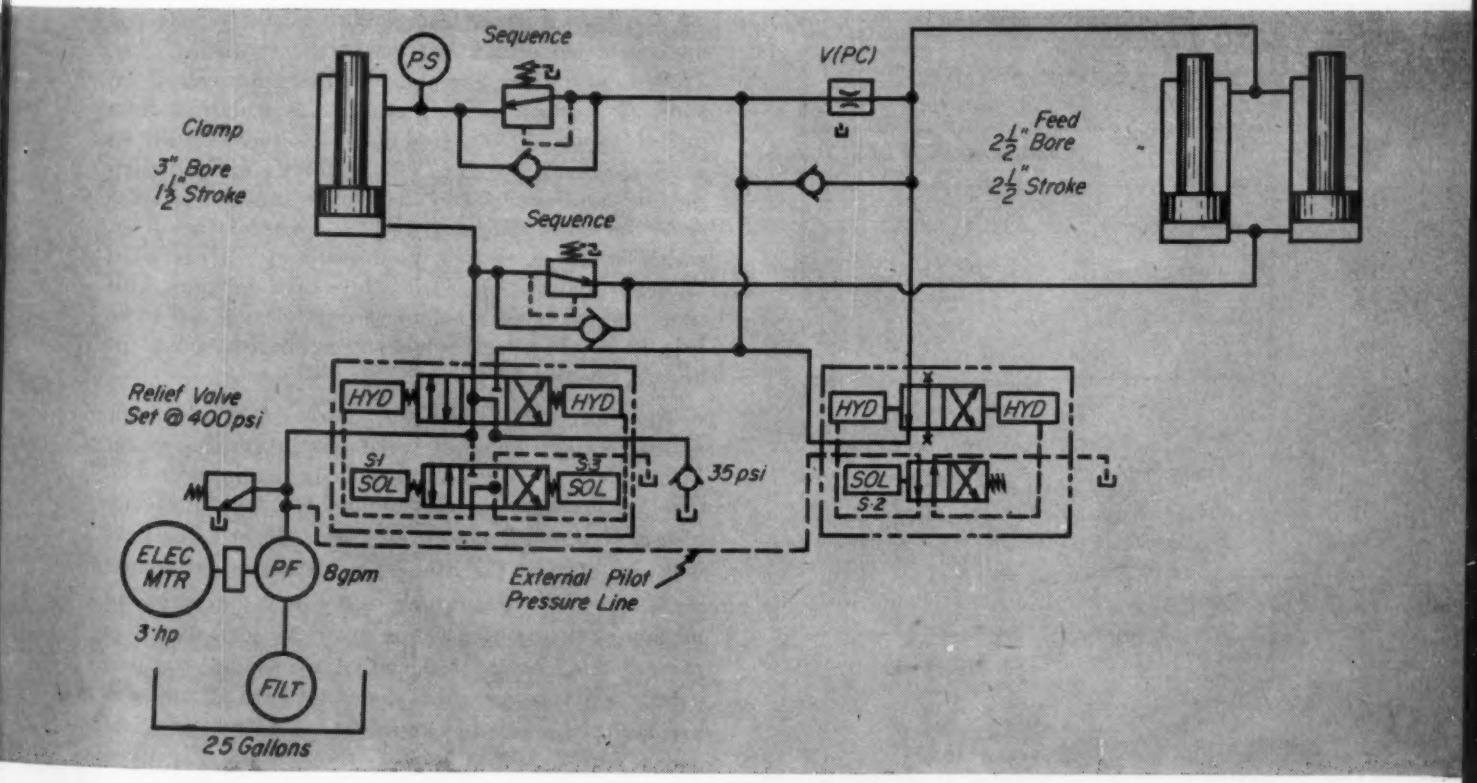


**ALL VALVES on the tool cut-off and feed circuit are gasket mounted on the opposite side of this panel. Panel connections are numbered to facilitate piping the circuit.**

The spool of the directional valve is designed so that during idle time, when the valve is in neutral, the rod end of the feed cylinder is blocked to prevent the tools from moving and causing a jam up and possible tool breakage when the next tube is fed into the spindle. Internal leakage in the valve has not caused the tools to creep during idle time; however, leakage at fittings could cause such movement and must be prevented.

Use of the panel mounted valves and tubing ar-

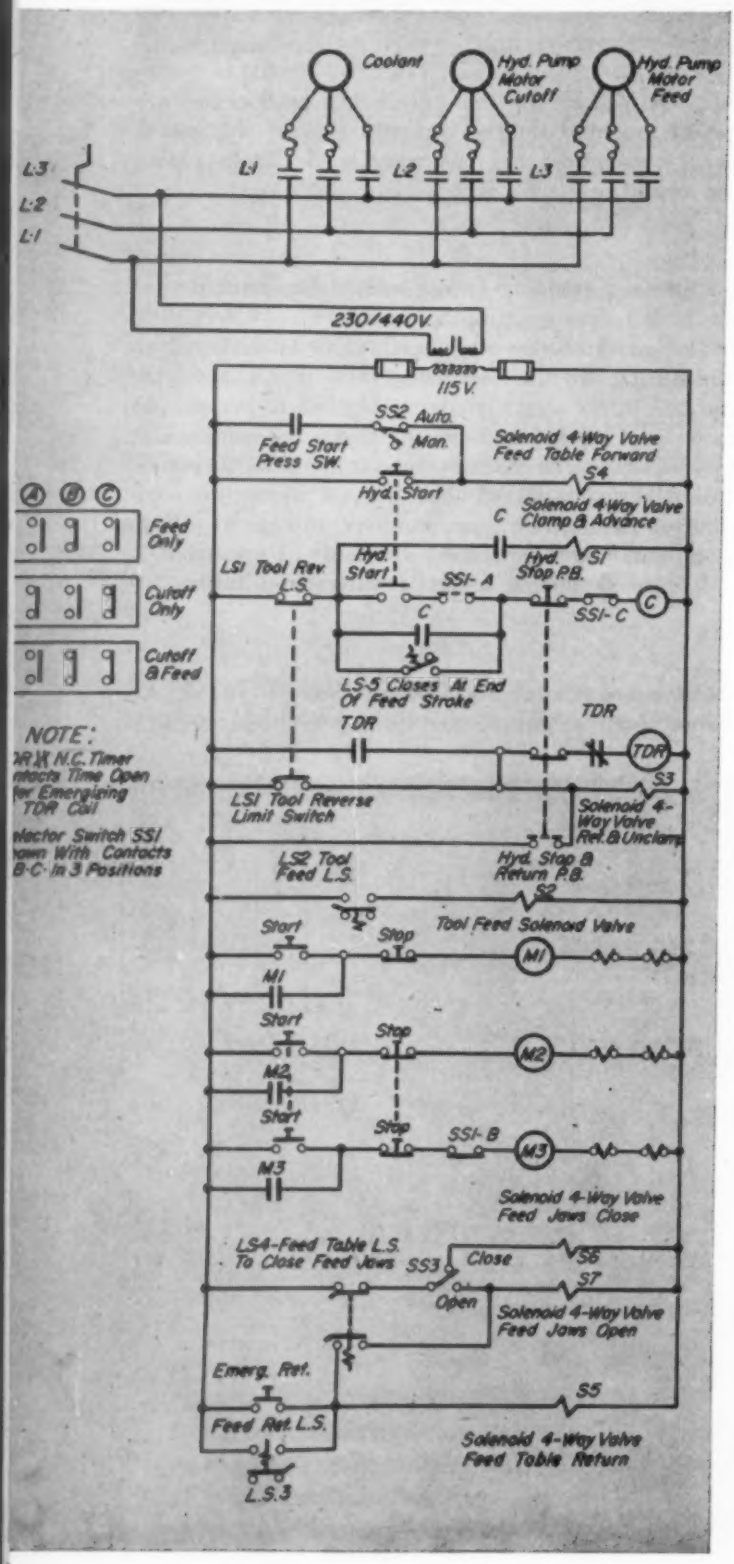
**TOOL CUT-OFF CIRCUIT uses sequence valves to insure clamp action before forward tool movement. A pilot operated solenoid controlled shut-off valve cuts the meter-out valve into and out of the feed circuit.**



rangement shown in the photograph has simplified the piping and reduced the number of possible leakage points. Both circuits—the cut-off and table feed—operate at low pressures which further minimizes maintenance troubles.

A 35 psi check valve in the drain line of the four-way spring centered valve maintains the minimum pilot pressure as the valve shifts across center.

ELECTRICAL control circuit for the cut-off machine.




## Electrical Control

A three position selector switch, SS1, used for machine adjustments during setup, permits operation of "feed only"—"cut-off only" or "cut-off and feed". There is also a manual and automatic selector switch, SS2, which, when placed on automatic, throws in the pressure switch. This pressure switch is in the oil pressure line on the rod end of the clamp cylinder on the cut-off. For an automatic cycle, pressure builds up and closes the pressure switch contacts after the clamps are fully open. Pressure switch actuation energizes the feed table solenoid to start the next tube forward. This pressure switch, five limit switches and a time delay relay control the automatic cycle of operation.

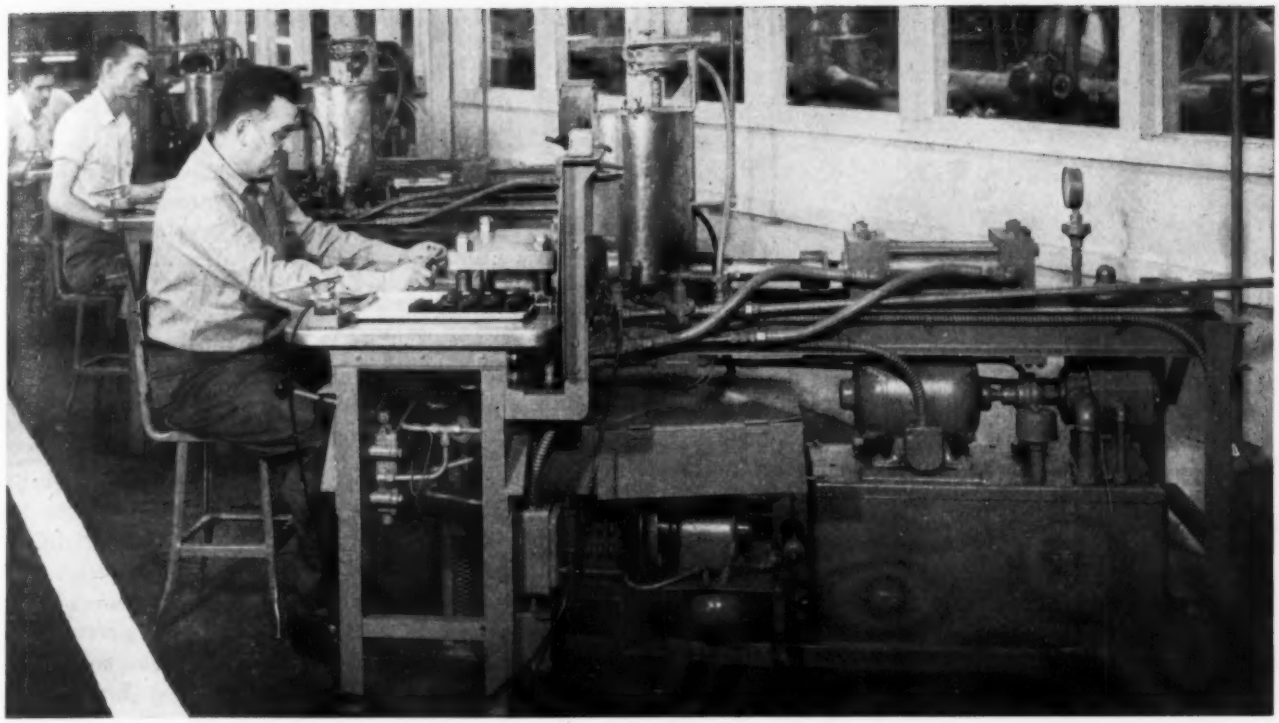
A third selector switch, SS3, is in the feed table clamp circuit. This is in the closed position except when a new length of tubing is being loaded into the table clamp fixture.

For an automatic cycle, the start button is pressed only once. The feed table forward solenoid, S-4, is energized. At the end of the forward stroke, limit switch 5 is closed by a cam on the feed table to energize relay "C" and start the cut-off cycle. One set of contacts "C" shunt around LS-5 and the start button to hold the relay energized. A second set of contacts "C" energize the clamp and tool advance solenoid S-1. As the cut-off tools advance, limit switch 3 closes to energize solenoids S-7 and S-5 opening the feed table clamp jaws and returning the table. When the feed table returns to its positive stop, limit switch 4 closes to energize solenoid S-6 and close the feed jaws.

Advance of the cut-off tools trips limit switch 2 to energize solenoid S-2 putting the tools into fine feed. At the end of the tool feed stroke, the tool reverse limit switch 1 is tripped, deenergizing the clamp and tool advance solenoid and energizing the tool retract and unclamp solenoid S-3. At this time the time delay relay, TDR, is also energized and its pair of normally open contacts are closed. The cut-off tools withdraw from the tubing and the tool feed cylinder returns LS-1 to its original normal position. This would normally deenergize the tool retract and unclamp solenoid S-3. However, the normally open TDR contacts of the timer, which is still energized, hold solenoid S-3 energized until normally closed TDR relays open on time. This time interval is adjusted to permit solenoid S-3 to be held energized after LS-1 has been shifted back to its normal position.

The time delay is necessary to make sure that the spring centered four-way valve does not shift to center before the sequence of the tools retracting and then the jaws unclamping the tubing has been fully completed. If insufficient time has been allowed, the jaws may not open at the completion of the cycle because the four-way valve will have shifted to center dumping oil to tank before oil pressure opens the sequence valve and oil flows to the rod end of the clamp cylinder.

Safe, efficient operation of this tube cut-off machine has been the result of careful design of the electrical and hydraulic control system.



**HYDRAULIC FORCE clamps two half sections of the master mold and injects wax into the mold cavities.**

# Small Power Input Develops 35 Tons in Manually Operated Machine

A hydraulic circuit which uses a variable volume pump and oil booster makes wax patterns for investment casting.

HIGH quality of finished pieces made by the "lost wax" or investment casting process, requires the use of precision wax patterns. Special oil powered, wax injection machines have been designed for making these patterns.

Two functions are performed by hydraulic cylinders on this manually operated machine. First, the die must be clamped and then the molten wax must be injected into the die cavities to form the patterns. Such operations, requiring straight line motion and forces as high as 35 tons are best performed with oil power. Along with meeting the functional requirements, the machine circuit was designed to use a small power input and to give long maintenance free operation. Efficiency from both a power and maintenance standpoint are of prime importance at the Bayonne, New Jersey Works of The International Nickel Company, Inc., where a battery of injection machines turn out thousands of wax patterns each month.

To accomplish the objectives of low power consumption and continuous operation, a low pressure, variable volume pumping unit in combination with a

**TYPICAL aircraft engine parts made by the lost wax process show the complex shapes which can be accurately cast.**

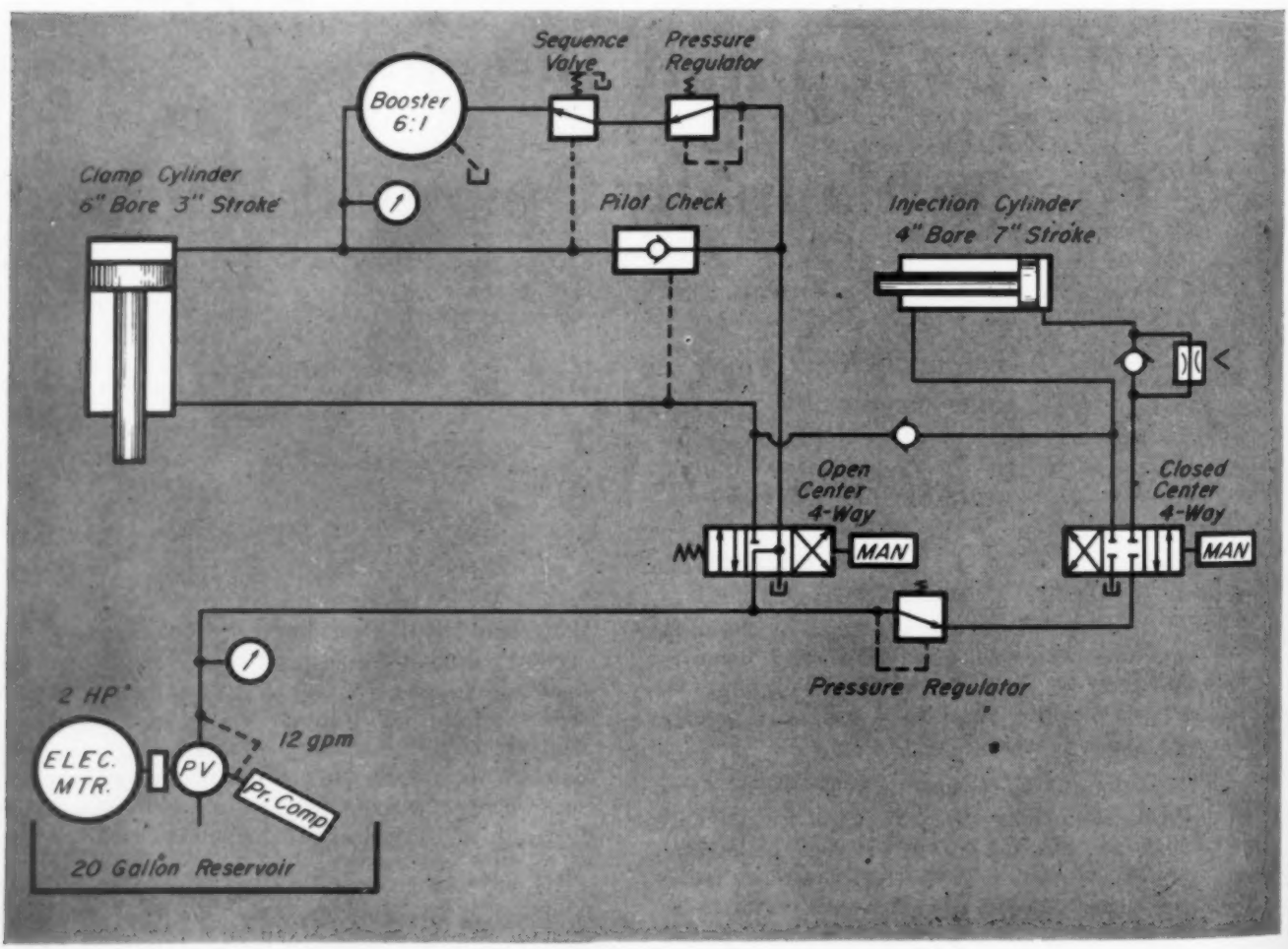
6:1 pressure booster were selected for this circuit. A two horsepower electric motor drives the pressure compensated vane type pump which has a maximum delivery of 12 gpm. The operator moves the open center 4-way valve to a detent clamp position which

***. . . reciprocating piston booster steps up 200 psi pump pressure to 1200 psi on the clamp***

directs the full pump volume to move the clamp down. When pressure builds up to the sequence valve setting, oil flow is directed through the booster to develop the heavy clamping force on the dies. Movement of the closed center 4-way valve in the injection cylinder circuit directs oil to inject wax and fill the mold. With the variable volume pump, oil delivery is a function of demand, and since the power input depends on the pressure and delivery, the required horsepower is minimized by using a variable volume pump.

Pressure at the pump is set at a maximum of 200 psi. The pressure booster steps this up to 1200 psi on the clamp cylinder. Because many different sizes and shapes of patterns are made, provision is made to adjust clamp and injection pressures and the speed of injection. This is done with the pressure regulator valves and the use of a needle flow control valve in the injection cylinder inlet line. Keeping high pressure oil isolated in one short line between the booster and clamp cylinder minimizes the possibility of leakage.

**PUMP PRESSURE on this clamp and injection circuit is a maximum of 200 psi. The booster develops the required large clamp force and confines the high pressure to a short run of tubing.**



## Design Check for Oil Temperature Regulation

- ✓ Sufficient air circulation around tank
- ✓ Unload pump volumes during idling and during low volume demand
- ✓ Varying oil delivery with demand
- ✓ Adequate heat exchanger
- ✓ Cooling water control valves
- ✓ Adequate reservoir size and baffle construction
- ✓ Correct pipe size

# OIL TEMPERATURE CONTROL on 1000 ton rubber curing presses

By R. L. Guggenheim

WHILE on most hydraulic machinery the designer is faced with providing for the dissipation of heat generated by approximately 20 percent of the power input, on the rubber curing presses described in this article, we must contend with additional heat generation caused by the steam heated platens. These platens are kept at a temperature of over 300 F. This heat not only serves the useful and necessary function of curing, it also has the disadvantage of adding heat to the hydraulic oil in the system.

Design of rubber curing press installations such as the battery of presses, Figure 1, which was built by Adamson United Company and installed in the new South Plainfield, New Jersey plant of Kentile, Inc. called for a design check on oil temperature control as shown in the accompanying table. Many of these check points are taken care of as a matter of sound design practice and good machine appearance without special

*R. L. GUGGENHEIM, Adamson United Company, Akron, Ohio*

**FIG. 1 BATTERY of 1000 ton rubber tile curing presses each individually powered by the hydraulic oil system mounted above each press.**

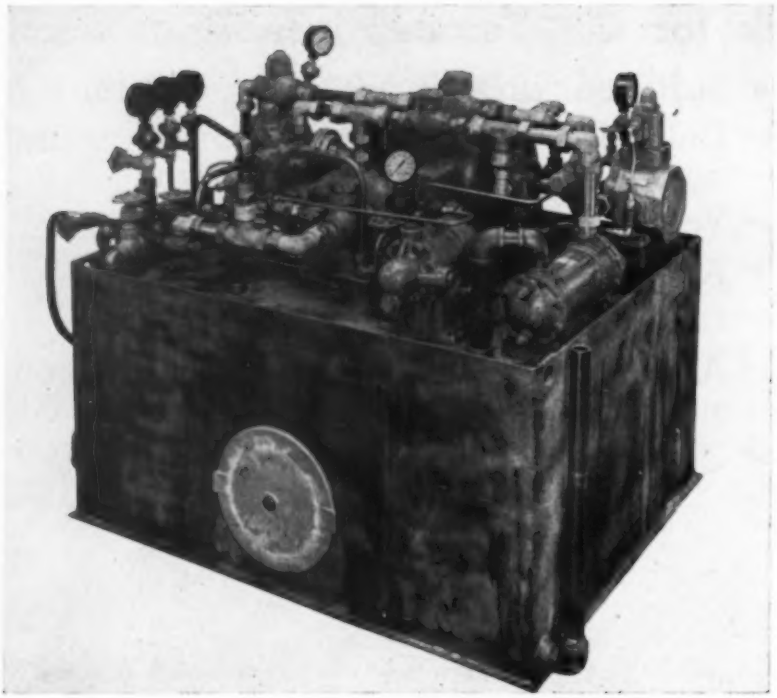


**FIG. 2. POWER PACKAGE used on each curing press has two variable volume vane pumps and a 3 to 1 booster which develops the 2000 psi curing pressure. The tube type oil cooler is mounted at the right.**

consideration to oil temperature.

Although temperature control of hydraulic oil is not usually a primary consideration in developing a design, as the design progresses attention to oil temperature is important. Oil temperature will influence construction and layout as well as the selection of pumps, reservoir and controls. After the designer has determined how he will supply sufficient oil at the required pressure to perform the job during the allotted time he will then be confronted with the problem of grouping the hydraulic components to provide the most efficient operation. And, of course, many decisions will be determined by limitations of space, time and cost.

Each of the presses in the Kentile battery has a capacity of 1000 tons developed by 2000 psi acting on

# How to Determine Heat Generation In Hydraulic Systems

Excessive heat in oil hydraulic systems will cause oil breakdown and result in reduced life of pump and valve parts. In applications where feed rate is critical, oil viscosity changes caused by heat will upset the operation.

Wherever there is a pressure drop or pressure loss in a system, this power loss is converted into heat and unless this heat is dissipated, there will be a rise in oil temperature.

If pressure drop and oil flow are known, the hydraulic energy or horsepower can be determined:

$$Hp = \frac{\frac{231\ in^3}{gal} \times \frac{gal}{min} \times \frac{lb}{in^2}}{\frac{12\ in}{ft} \times \frac{33000\ ft\text{-}lb}{min}}$$

This horsepower loss can be quickly converted to heat energy by multiplying by 42.4 which is the Btu/min equivalent energy for one horsepower.

Knowing the specific heat of oil to be approximately .42 Btu/min and the specific weight is approximately .85, then the temperature rise for each gallon of oil is equal to:

$$\text{Temp rise } °F = \frac{\text{Btu/min}}{\text{Specific heat of oil} \times \text{quantity of oil in lbs/min}}$$

Another approach would be to assume that a percentage of the total hydraulic horsepower developed will be lost for useful work in the form of heat. This percentage can be converted to Btu and the temperature rise established. If this rise is excessive and can not be dissipated by normal radiation, oil cooling methods will have to be considered.

the 36 inch diameter press ram. Rapid approach and retraction of the press is accomplished with two double acting 8 inch diameter, 17 inch stroke "kicker" cylinders. Each press is individually powered by the oil circuit shown schematically in Figure 3. The pumps, booster and valve components are mounted on the reservoir as shown in Figure 2.

### *Reservoir Size*

Sufficient floor to ceiling space was available in the Kentile plant to place the power package above the press giving an overall height greater than 16 feet and permitting a 6 inch air space for ventilation between the top of the press and the bottom of the reservoir. The reservoir width, 44 inches, and length, 55 inches, were determined by the press dimensions so that there would not be any objectionable overhang of the reservoir beyond the press frame. Using a reservoir depth of 38 inches, an oil capacity exceeding three times the total maximum pump capacities of 40 gpm plus the 66 gallon required for prefill of the main ram is easily held.

Oil power for each curing press is supplied by two 20 gpm variable volume vane type pumps driven by

***. . . during press idle time, half the pump volume goes through the oil cooler***

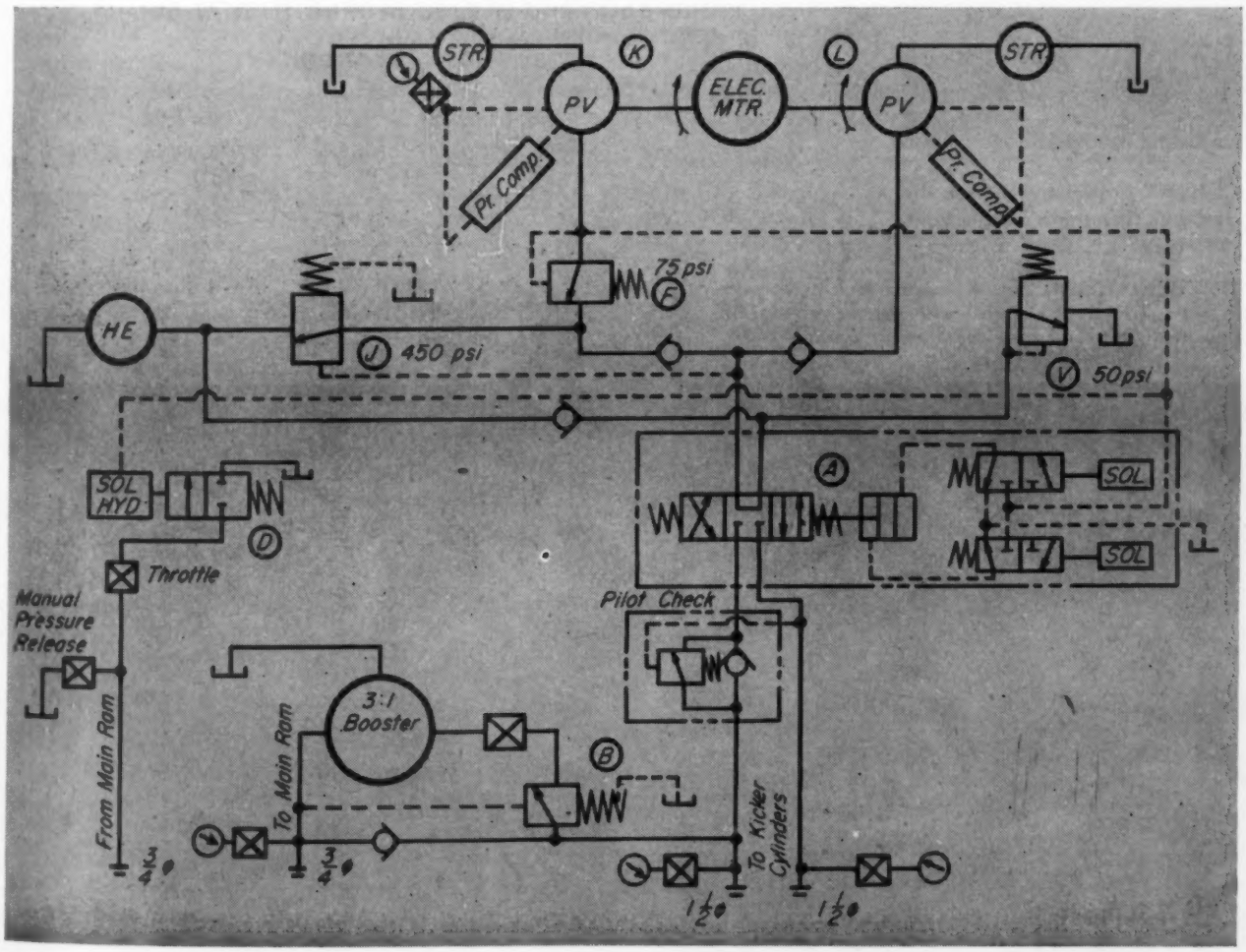
a double ended 15 hp electric motor. Referring to the schematic, Figure 3, pump K is equipped with a dual pressure control which provides a minimum operating pressure of 75 psi and maximum of 350 psi. Pump L has a standard spring loaded pressure governor set at 650 psi. The use of variable volume pumps, in itself, helps to minimize heat generation because during the work cycle the pump delivers only the amount of oil which the system demands — there is no excess oil dumping through a high pressure relief valve.

During the rapid approach and return of the press ram, both pumps supply oil through the 1½ inch line to the "kicker" cylinders. Oil for rapid approach of the main ram is supplied through a prefill valve which is not a part of the circuit shown in Figure 3.

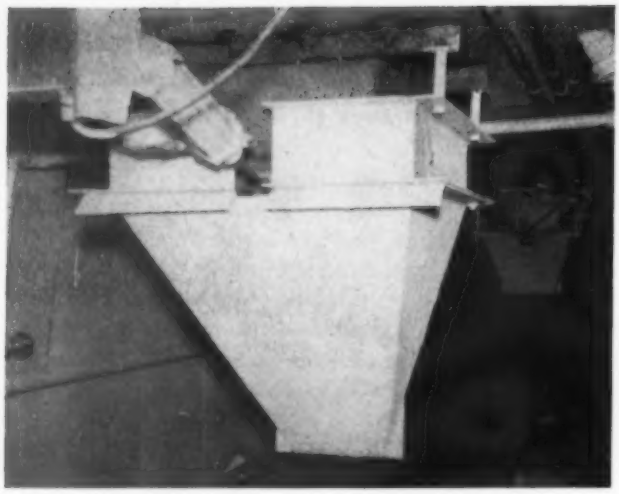
Valve F maintains pilot pressure on the 4-way control valve A. When pressure developed by pump L builds up to the 450 psi setting of unloading valve J, the oil delivery of pump K will dump at the low 75 psi through the tube type heat exchanger and back to

Concluded on page 78

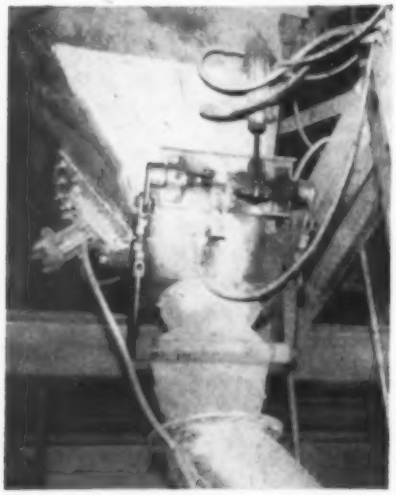
**FIG. 3. CIRCUIT drawing of the press power unit shows the pump unloading circuit arranged to keep oil circulating temperatures at a safe operating level.**



# AIR POWER H



1. LOOKING into the tunnel at the Clifton plant where air cylinder operated dump gates discharge sand and aggregate onto a belt conveyor.

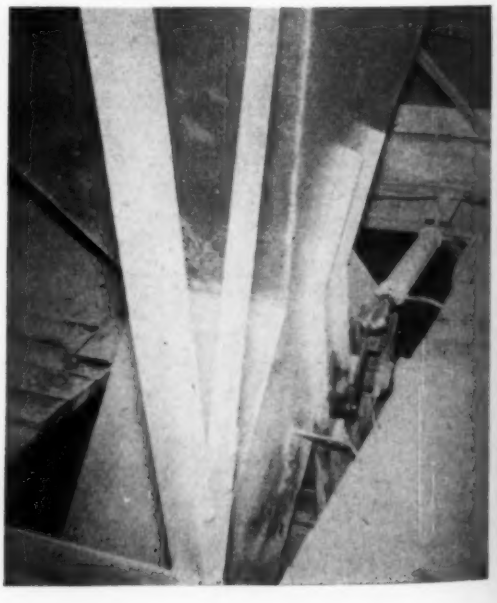


2. CEMENT is discharged from the storage bins through a canvas boot.

Air cylinders operate gates, chutes and valves in a modern plant making concrete mixes. Operations which include weighing, measuring, separating and dumping limestone and sand are controlled from a central control station.

3. DOUBLE ACTING cylinders open and close clamshell gates under the sand and aggregate storage bins to drop material into the weighing bin.

4. A FLOP VALVE fitted into the throat of a divided chute diverts material into the correct mixer.



5. AT
TION
mount

# ER Handles Biggest Mixer

THE three mixer concrete plant of Cleveland's Clifton Concrete and Supply Co. is the largest plant of its type anywhere. It has a capacity of up to 1400 cubic yards of concrete mix per 8 hour day. It is the first in which a complete air system was designed to power practically all the work including the operation of dump and weighing gates, mixer tilt and dump truck cylinders.

The mix plant is 110 feet high and was designed for efficiency whether one, two or three mixers were in operation at any one time. Two mixers supply one truck drive-through, the third supplies a second drive-through.

By location, nine cylinders are located on dump bins in "The Tunnel" located under the piles of sand and aggregate in the yard; nine cylinders are on one side of the plant that serves two mixers and eight cylinders are on the side which serves a single mixer. On both sides of the plant the cylinders actuate all measuring, weighing, separating and dumping operations from top storage bins to truck loading at ground level.

A belt conveyor runs the length of the tunnel under adjacent piles of aggregate in the Clifton yard. A total of nine dump bins, one under each size of limestone and of sand (Figure 1), have shut-off gates which are opened and closed by the extension and retraction of double acting, clevis mounted air cylinders. Each cylinder is controlled by a single solenoid, 4-way, 2-position air valve. The tunnel circuit is separate from the circuits in the plant itself.

### *Distribution of Materials*

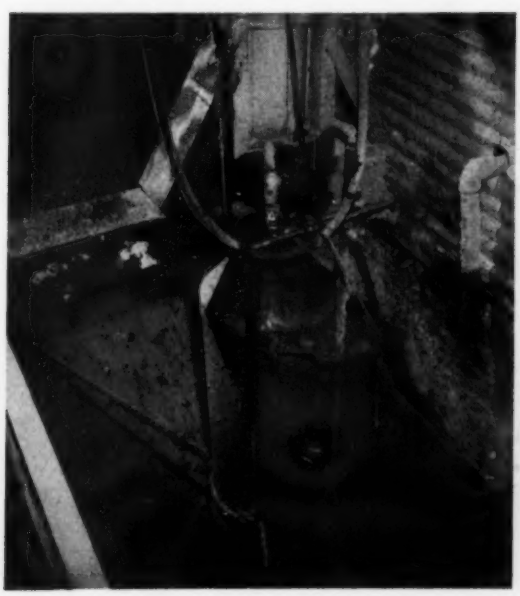
The horizontal belt conveyor carries sand and aggregate to the end of the tunnel where it drops off material onto an inclined belt which carries materials to the top of the plant, where storage bins for cement, sand and different size gradations of stone or slag are located. An operator at this point manually swings a locating chute over the proper bin as different materials are delivered.

From the storage bins all flow of materials is by gravity. A special arrangement is provided to dump the cement. A canvas boot at the base of the cement

Continued on page 74

**5.** AT THE CENTRAL CONTROL STATION lever operated valves are flange mounted on two boards.

**6.** A VERTICALLY MOUNTED air cylinder "pulls the plug" in the holding bin to discharge the mix.



**7.** THE TRUCK DRIVER operates a valve on the side wall of the drive-through to discharge his mix.

# The Development of

By John W. Overbeke

*The hydraulic accumulator is a mechanical unit which can be loaded in such a manner as to store potential energy to do useful work. Energy can be given up to produce a controllable dynamic force against the pistons of linear or rotary action hydraulic motors. Loading is accomplished by pumping a hydraulic fluid against the load or resistance.*

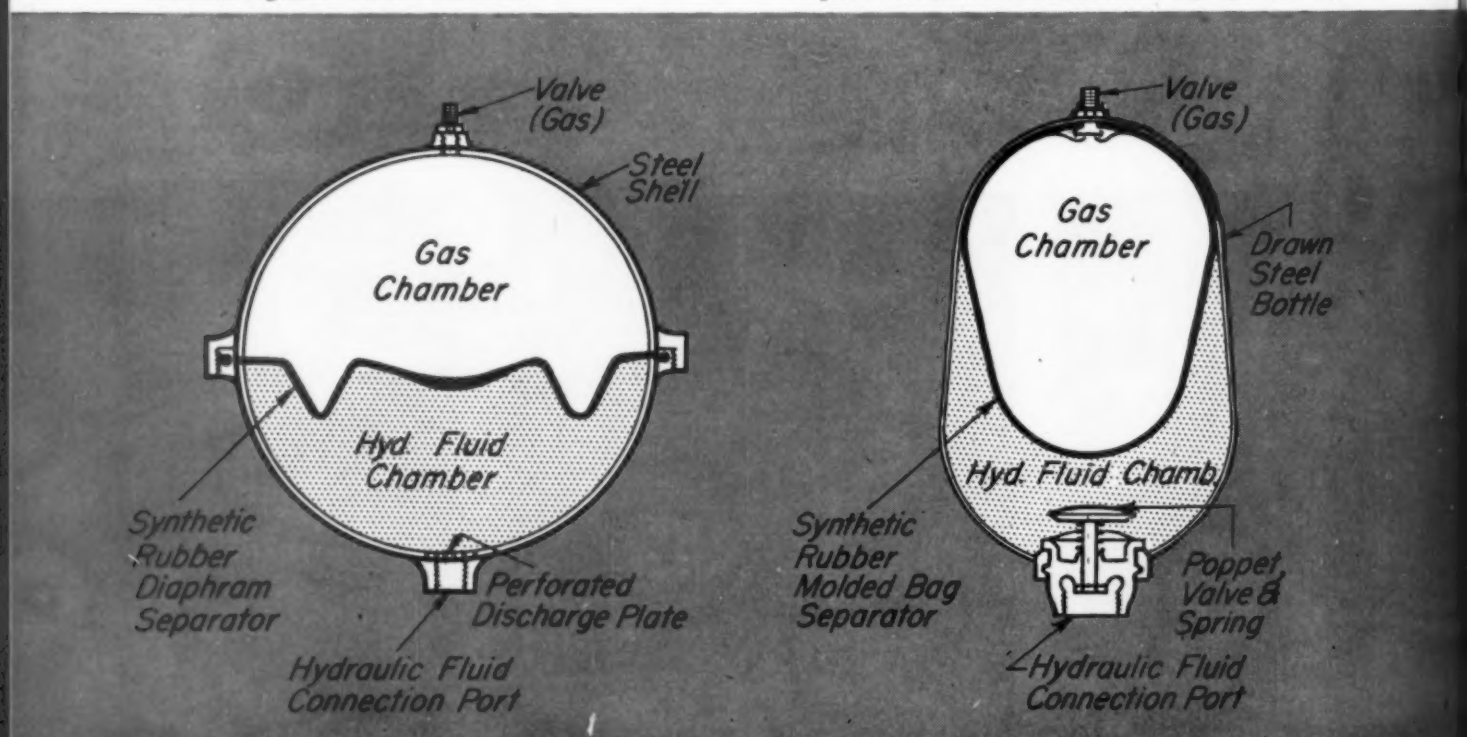
THE accumulator has been used for many years. The gravity or deadweight accumulator, first developed for use with water hydraulic systems, the spring loaded and the hydro-pneumatic types have been and still are widely used in industry. In this article we will confine ourselves to the gas compressibility types for gas pressures to 2200 psi and hydraulic operating pressures to 3000 psi. In this general group a simple division is non-separator or air bottle types of accumulators and the separator types. We will limit our discussion to the three types of separators: (1) the diaphragm; (2) the bag; and (3) the "O" ring sealed piston construction.

While accumulators are used for both aircraft and industrial applications, the role of aircraft in the development and introduction of all three of these types is marked.

Figure 1 illustrates the typical construction of the diaphragm separator type accumulator. Developed for and used in Army and Navy aircraft hydraulic systems since the beginning of World War II, this accumulator uses a synthetic rubber diaphragm. The main oper-

**FIG. 1. TYPICAL design of the diaphragm separator type accumulator. Two machined hemispheres are fastened together to form the shell.**

**FIG. 2. THE CONICAL type bag accumulator has a gas valve insert molded in the upper half of the two piece molded seam bladder and a plug assembly.**



# Cylindrical Piston Accumulators

ating difficulty with this type was the failures at temperatures below —50 F. This type has now been superceded by the cylindrical type.

### *Bladder Type Units*

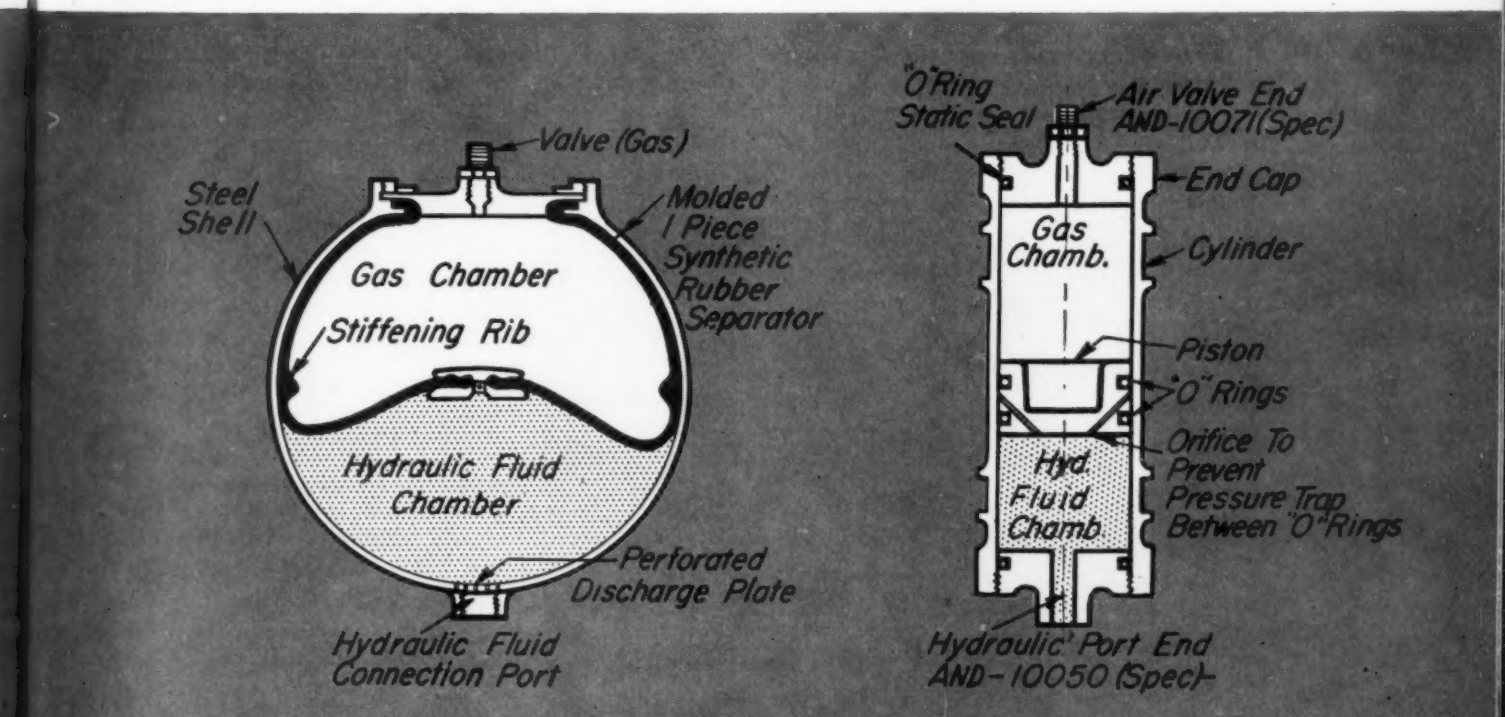
Two types of bladder or bag separator type accumulators, the spherical and the conical, are in use. The spherical accumulator was developed primarily for aircraft hydraulic systems. Several types were developed. The spherical unit shown in Figure 3 has an open mouth type bag with an internal hemispherical rib arranged to minimize trapping of hydraulic fluid when the unit is installed in different positions. The lower part of the bag carries a metal plate which seats upon a perforated discharge plate at the hydraulic outlet to prevent extrusion of the rubber. Each of the spherical types, except one, is made of two hemispherical shells; some types are machined, others are drawn. The spherical type has found relatively few applications in other than aircraft systems.

The second bladder or bag type separator is the conical bag accumulator. This design, Figure 2, has a fully enclosed bag of molded seam construction of two synthetic rubber pieces with a gas valve insert molded in one half. The high pressure shell is spun spherical at both ends. An opening at one end accommodates an air valve. The bag is inserted through a larger opening on the fluid end. A plug assembly containing the oil port seals the fluid opening. A poppet valve, held open by a calibrated spring, with a guide at its lower end prevents extrusion of the bag when hydraulic fluid is exhausted.

The conical bag type is used in both aircraft and

**FIG. 3. THE SPHERICAL type bag accumulator has a metal plate in the lower part of the bag which sets upon a perforated discharge plate at the hydraulic outlet.**

**FIG. 4. A SINGLE SHELL cylindrical accumulator to meet spec MIL-A-5498, Type 11, designed for aircraft hydraulic systems.**



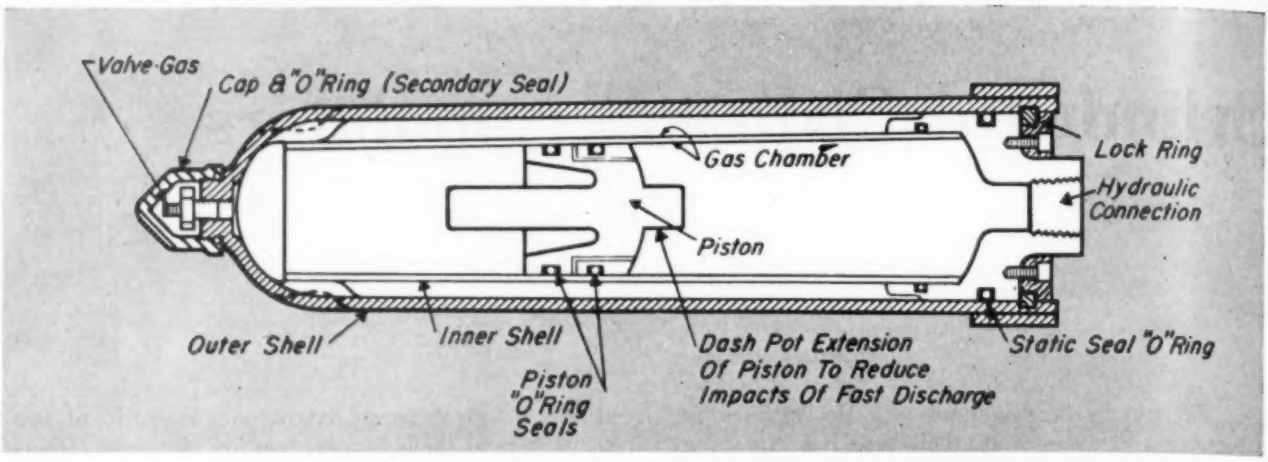



**FIG. 5. A TYPICAL double shell cylindrical accumulator for both aircraft and industrial applications. This type, in its larger capacities, is well adapted to heavy duty industrial circuits.**

industrial applications. It is presently the most widely used type in industrial applications.

The design of the conical type bag accumulator requires that it be installed in a vertical position with the air end up to avoid trapping of hydraulic fluid when discharging. Both types of bag accumulators are subject to low temperature difficulties. After cycling at 160 F, some of the plasticizers are lost resulting in stiffness of synthetic rubber compounds when cycling at temperatures below —50 F. Severe local flexure stresses develop and tend to crack or rupture the molded bag.

### *Piston Accumulators*

In an effort to eliminate a number of difficulties encountered with the diaphragm type accumulators on military aircraft, the BuAer in collaboration with engineers of airframe companies and the Air Force set up and adopted as standard a specification for a single shell, piston type cylindrical accumulator (MIL-A-5498, Type II and MS-28700 envelope drawings). Figure 4 is a typical accumulator to this specification. In addition to eliminating diaphragm type failures at temperatures below —50 F, advantage was taken of the fact that in the piston type volumetric efficiencies up to 95 percent, depending on the precharge, are available, due to the constant area piston movement during discharge for flow. The fact that standard "O" rings could be used for both actuating cylinders and accumulators, simplified the military stocking problem. A design advantage, important in crowded "hell holes" of military aircraft, is that the piston type accumulator with "O" ring seals does not impose restrictions on installation position. This type is now being built by several manufacturers to the specification for both military aircraft and industrial use.

Several variations of the single shell piston accumulators are finding their way into industrial applications. Some applications are in hydraulic steering

Concluded on page 80

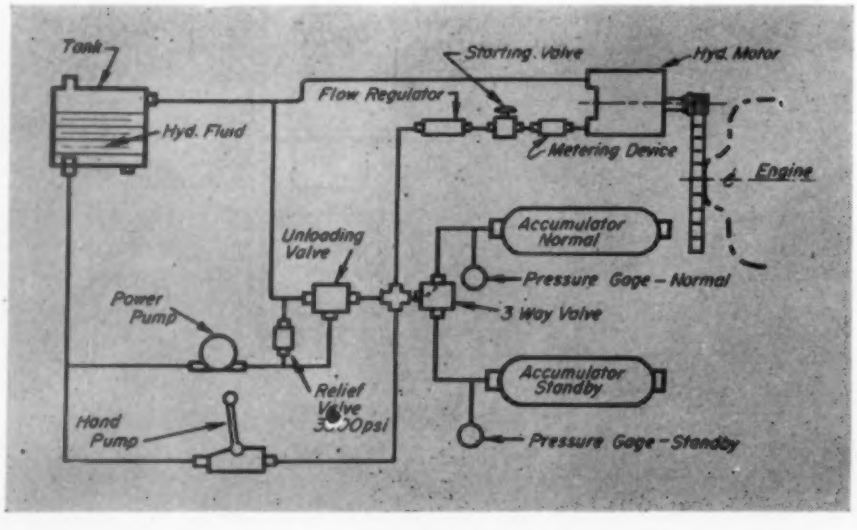
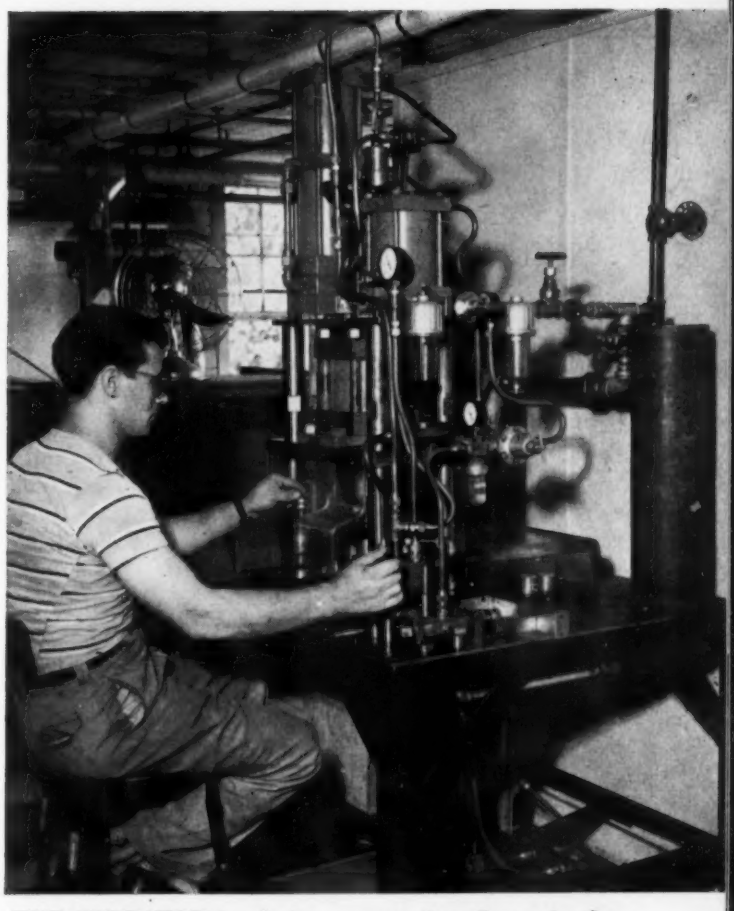



**FIG. 6. DIAGRAM of the hydraulic circuit with a closed circuit accumulator-unloading valve system. The hand pump is for emergency operation.**

# Special Press Has Simple Air-Oil Booster Circuit



**THE OPERATOR is placing a mounting flange in the loading station of the press. By operating the outer valve at his right, he is preparing to rotate the loaded station to the stamping position.**

*Need a special press? Here is how one company, using standard air components, built a press which increased production 600 percent. The savings on tools alone as compared to tool costs on the press which was replaced will be enough to pay for the new machine in four years.*

AT the Ashland, Mass., plant of Fenwal Incorporated, manufacturers of temperature control devices, one of the production bottlenecks—stamping the triangular mounting flanges with trade mark, distinguishing lettering and figures—was cleared away by a novel and efficient two-station marking press. Operations are actuated by two circuits; a major circuit, incorporating an air-oil booster to power the work cylinder; an auxiliary circuit, incorporating an air cylinder to actuate an ingenious index-bar arrangement to rotate the work holding fixture.

A stamping machine, formerly used, was a single station unit operated by toggle link action and powered by a large air cylinder. This machine had been in operation for several years and had proved adequate for short runs when production demands had been moderate. However, with the impact of greatly increased production demands to meet military needs, the old machine was so severely overloaded that breakdowns were frequent and production flow was seriously impeded. It was determined that a new machine of ample capacity was necessary.

As no stamping machine of the required type was available commercially, it was obvious that a specially designed machine would have to be built. The Methods Department was given the assignment. Alex M. Duncan, senior project and development engineer and Karl Nowak, manufacturing superintendent, worked out a design and directed the building. Except for the operating cylinders, sequence and control valves, the stamping press was entirely a Fenwal product, both in conception and construction.

### *Utilization of Shop Air*

After a preliminary investigation, it was decided that a combined air-oil system that could utilize shop air should be used. Harold Hemming of Gibson Engineering Co., Boston, was consulted. A five-inch diameter hydraulic work cylinder, actuated by a five-inch diameter air-oil booster cylinder, with a 25 to 1 ratio, was finally chosen. This gave an effective pressure of from twenty to twenty-two tons, using air from the plant air lines in the booster air cylinder. Any lower

***. . . rapid advance before high pressure squeeze is achieved with a time delay valve in the booster circuit***

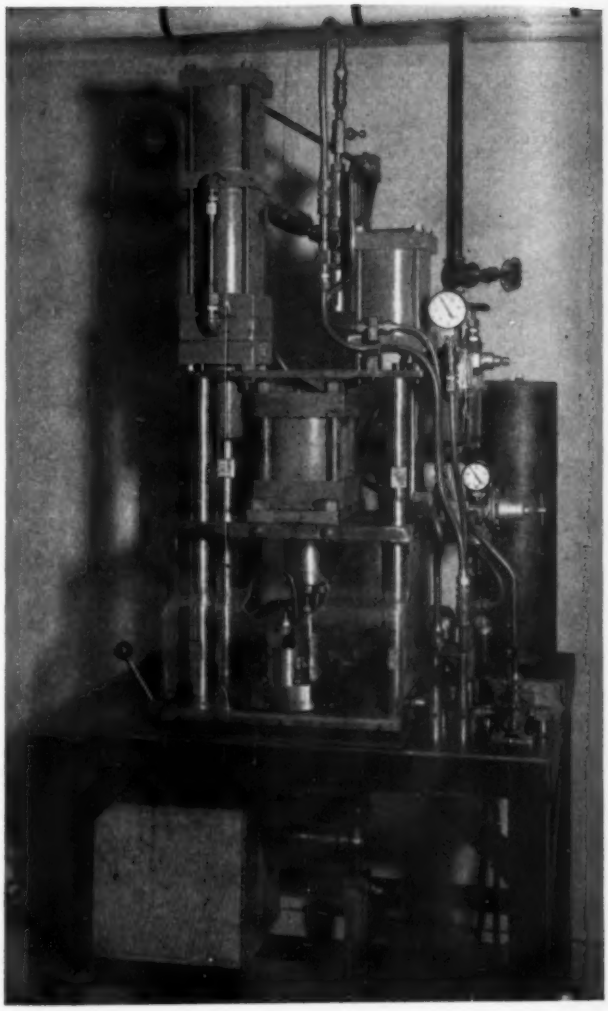
pressure is attained by reducing valve adjustment.

The power units having been decided upon, the design of the machine was then developed around them. A two-station revolving work holding fixture was incorporated so that one station could be unloaded and reloaded by the operator while the other station is in operation.

Two power systems were built into the unit. The main power system centers about the booster and work cylinders and provides the energy required to force the stamp faces into the upper and lower surfaces of the flanges, which are of stainless steel. This system, comprises, in addition to the cylinders, oil storage tanks, three-way manual air valve, sequence valve, supporting framework and all related parts, are mounted on top of the rugged steel stand fabricated by arc welding.

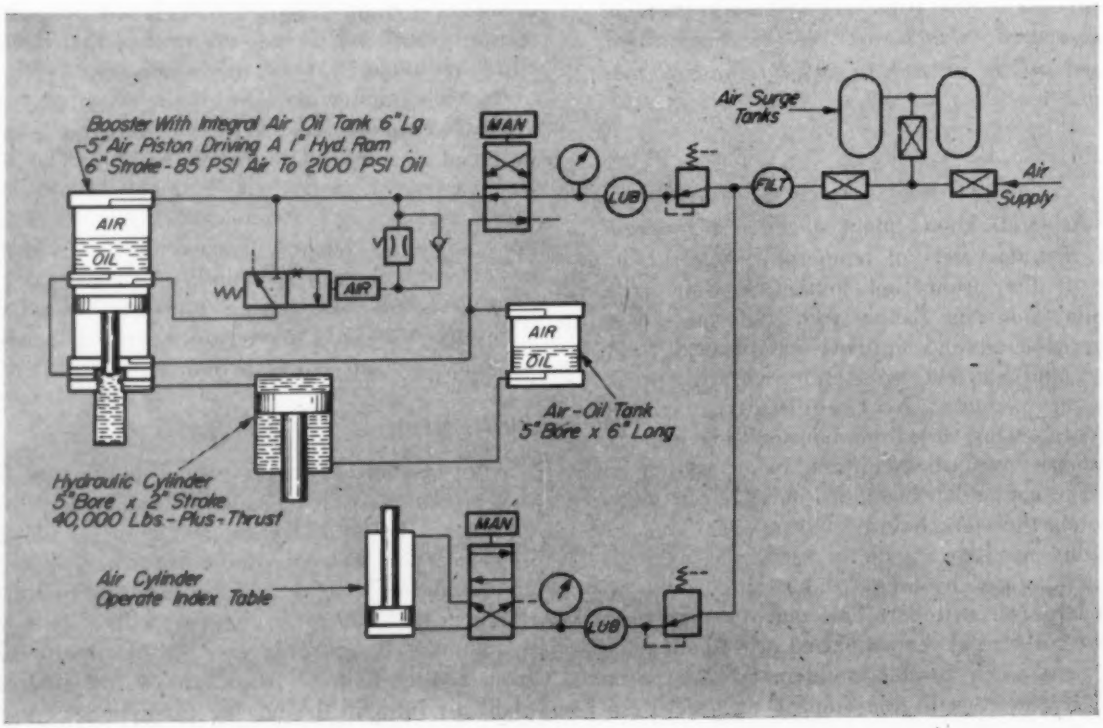
The auxiliary system is operated from a small diameter, long stroke air cylinder connected to a rocker-shaft, mounted under the table. This air cylinder actuates an index lock-bar by a hinged cam plate, which has positive action in withdrawing the index bar and

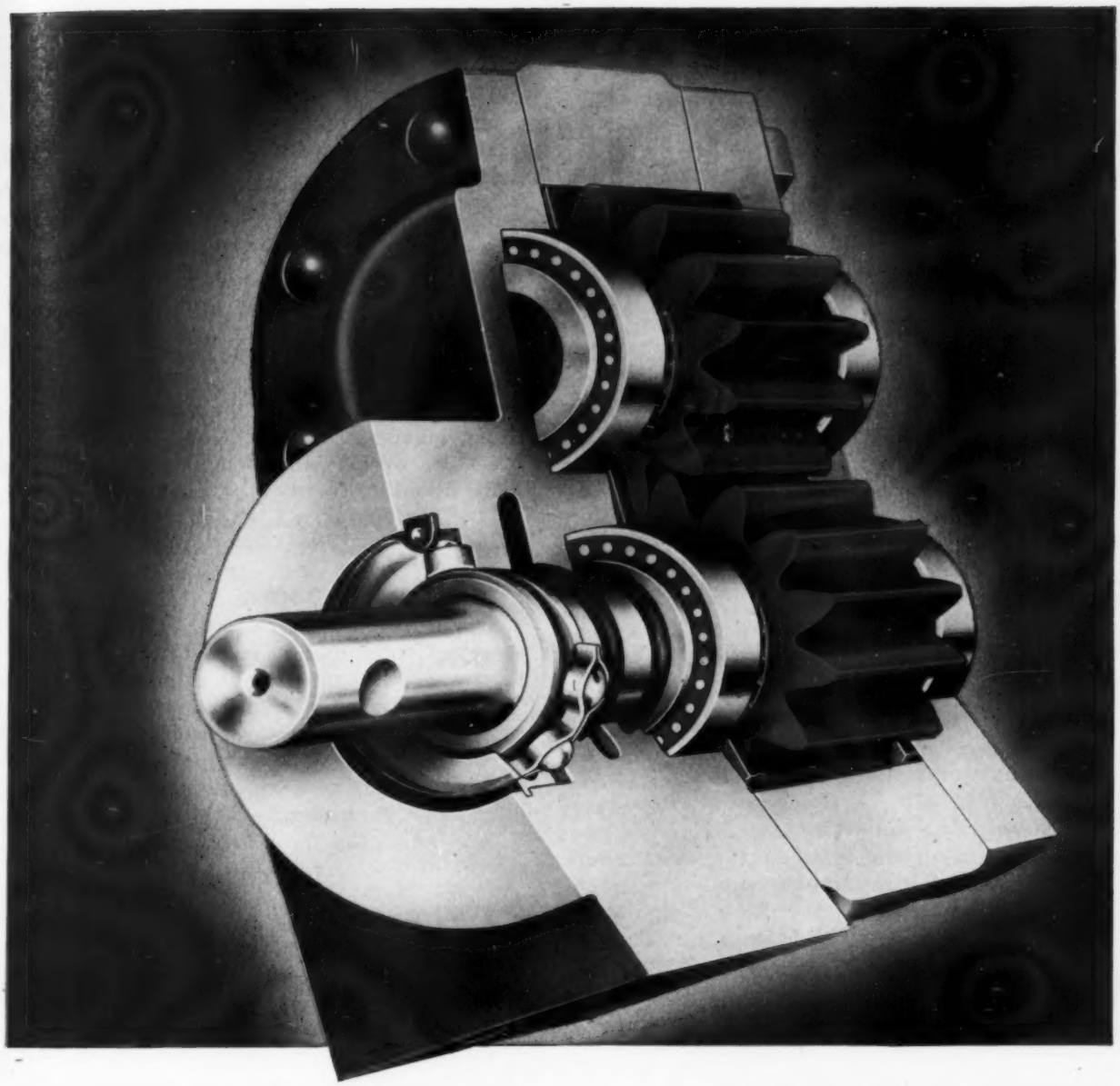
Continued on page 76



**FRONT VIEW of the two-station indexing press showing the air-oil booster (left, top), work cylinder (center) and a separate oil reservoir (right, top) for returning the work cylinder. One of the two air surge tanks as seen at the rear of the table. The air cylinder, shown below the table, is connected to a rocker shaft which actuates the index lock-bar by a hinged cam plate.**

**HYDRAULIC-AIR circuit of the marking press.**





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# USEFUL LITERATURE

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**VARIABLE SPEED MOTORS** . . . A completely revised and enlarged in scope, 16 page multicolored Bulletin, No. 1797, has been issued by U. S. Electrical Motors Inc. It outlines several scores of reasons why variable speed motors can be used to improve production and includes illustrations of all types of Varidrive motors. Shown are 80 colored illustrations of motors, mechanical features and remote controls.

Circle 176 on Reader Service Card

**ROLLER CHAIN** . . . The riveted chain which is as easy to couple or uncouple as cottered chain, is described in detail in a new bulletin, No. 52-2, released by Baldwin Duckworth, Division of Chain Belt Company. One section of the book shows how the chain is made up to any length. Features of the chain and the single pin coupler link are illustrated and described. Assembly diagrams and charts for all size chains are presented. Also given are strengths, dimensions and weights of standard roller chain.

Circle 177 on Reader Service Card

**HYDRAULIC VALVES** . . . Fluid Controls Inc. issued a colorful 4-page booklet illustrating and describing the three general classifications of hydraulic valves and devices they manufacture. A number of these valves are pictured and applications on material handling equipment, mining machinery, machine tools and testing equipment are shown.

Circle 178 on Reader Service Card

**HYDRAULIC QUICK COUPLERS** . . . Pioneer Hydraulics, Inc., published a data sheet illustrating and describing two new models of quick connect and disconnect couplers for farm tractors and industrial hydraulic systems. Both models 4000 and 5000 are made for ⅜, ½ and ¾ inch hose, provide positive flow or shut off and are guaranteed not to leak. Pioneer couplings are of rugged construction for extreme pressures, both models will operate at pressures up to 6000 psi, yet are light in weight, easy and fast in operation. The couplings are equipped with the finest steel ball checks for positive sealing, maximum flow and long life. They may be used as a break-away coupler when installed on the Pioneer Break-away Clamp.

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**ELECTRIC MOTORS** . . . The Louis Allis Co. has prepared Bulletin No. 1300, on its line of wound rotor motors of ½ to 1000 hp. The bulletin covers wound rotor principles of operation and contains performance curves and characteristics which show how these units are suited to particular jobs in industry. Also outlined are the construction, methods of manufacture, and the various enclosures available.

Circle 180 on Reader Service Card

**AIR CYLINDERS** . . . A new bulletin published by Carter Controls, Inc., describes the features of their complete line of cylinders. The dimensions are given for the six standard mounting styles, a complete cross section diagram and parts list is furnished, and there is a dimensional chart for rod eye and rod clevis. Full data on the range of seven standard diameters and their corresponding physical dimensions are included in the bulletin, which should be a useful reference for engineers and production people interested in pneumatic cylinders.

Circle 181 on Reader Service Card

**HYDRAULIC DIRECTIONAL CONTROL VALVES** . . . Available with from one to three plungers to control individually single or double acting cylinders, the Hydreco V-12 series valves are illustrated in a 4-page folder. Design features are outlined for these valves, which have a maximum capacity of 50 gpm and will operate at pressures up to 1400 psi. The patented hollow plunger design with built-in checks to assure positive starts and stops is shown along with the built-in differential relief valve which is standard on these valves. Mounting and dimensional data is given.

Circle 182 on Reader Service Card

*For more reviews of recent literature turn to page* 106



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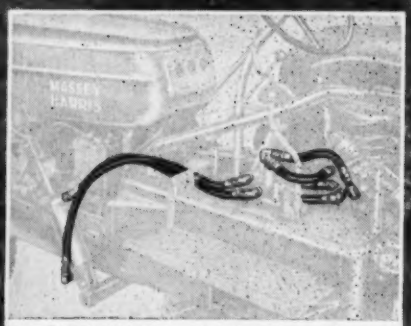

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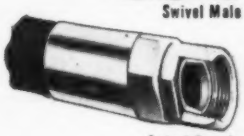

Swivel Female

**STRAIGHT AND ANGLED ADAPTER UNIONS**

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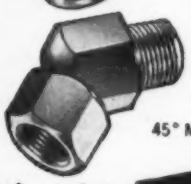

45° Male

Thanks to hydraulic power, many a man's job on the farm is a boy's job now! Fingertip hydraulic control does away with aching arms, dog-tired from day-long tugging at levers to raise and lower tillage tools.

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EASTMAN Hydraulic Hose Assemblies carry oil at 1000 psi from the Massey-Harris 2-Way, 2-Speed *"Depth-O-Matic"* Hydraulic Control to raise and lower tractor mounted implements smoothly, easily, swiftly. Synchronized slave cylinders handle harrows, discs, plows.

Massey-Harris *"Selective Control"* maintains uniform cultivator penetration on hillside contour slopes, pictured above, through independent action of right and left gangs. *"Delayed Action"* permits raising front and rear gangs independently at contour points, also permits shovels to leave and enter soil at same point at ends of rows.

Other users of EASTMAN Hydraulic Hose Assemblies in the agricultural field include: Allis-Chalmers Mfg. Co.; J. I Case; John Deere Co.; The Farmhand Co.; Harry Ferguson, Inc.; Horn Manufacturing Co.; International Harvester Co.; Minneapolis-Moline Co.; Ottawa Steel Products Co.; Super-Six Manufacturing Co.; A. F. Wagner Iron Works.

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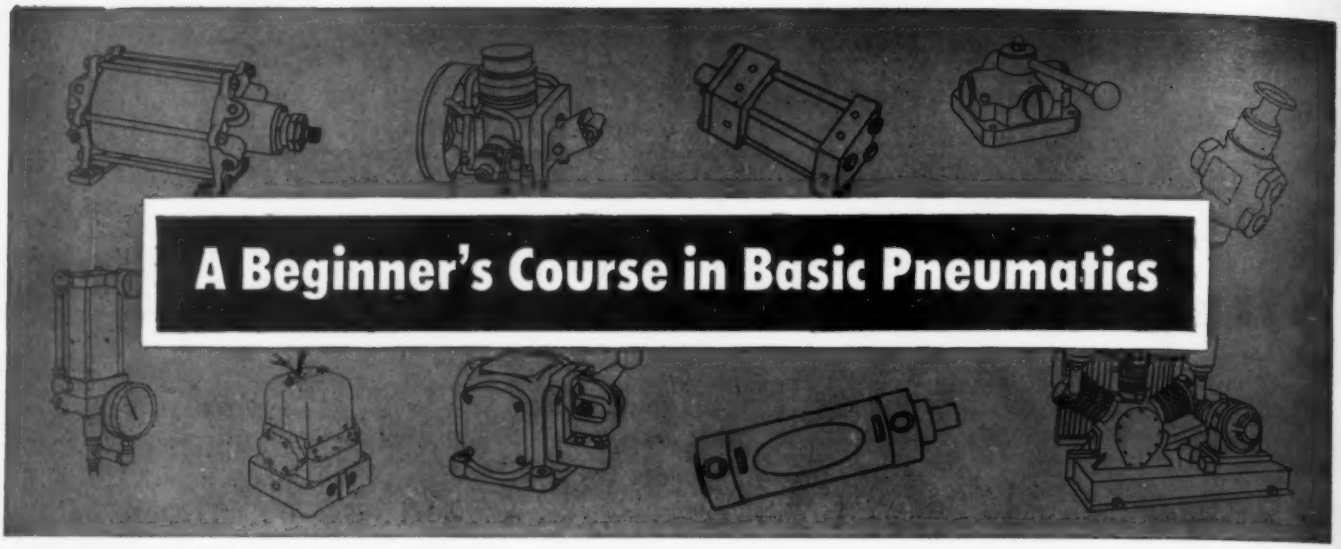

# A Beginner's Course in Basic Pneumatics

**Section III Power and Working Elements**

## Air Cylinders (cont'd)

**Part 2**

TO select air cylinders the power requirement and the nature of the work cycle must be clearly understood. The designer, machine builder or other user of air for power will know the operating speed and the length of stroke required. From the air pressure available at the cylinder he can then select the correct size bore and length of cylinder that will give the force required. There may be several combinations of sizes and lengths available from which to select one that is the most efficient from the stand point of air consumption, installation requirements and operating features. The cost factor must always be considered. Small diameter cylinders with long strokes generally cost less than larger diameter, short stroke cylinders. They also permit better control with less friction and consume less air for a given work load.

The nature of the work load must also be understood in order that air cylinders be selected properly. On heavy duty machines or equipment that operates continuously and accumulates thousands of cycles per day, higher quality cylinders of better construction features and materials are likely to be the proper choice. This may be even truer on mobile equipment, especially where cylinders may be exposed to extreme ambients (temperature, contaminants and accidental damage hazards) or where they must operate for long periods with little or no preventive maintenance. Light duty cycles or intermittent duty requirements may permit the selection of less costly cylinders without sacrificing an adequate margin of safety. On other occasions, speed control or sequencing of operations may be critical or a cylinder may be installed on equipment where changes in work stroke may be necessary from one job to another.

With well over fifty manufacturers offering lines of air cylinders, a wide range of designs and types is available. While general performance standards have been setup*, no industry wide design standards have been established. However, manufacturers' specification or data sheets are fairly uniform and contain sufficient information for all practical purposes. Such specifications always include recommended operating pressures and services, give distinctive design details,

**J.I.C. Pneumatic Standards for Industrial Equipment, section A6.3, Cylinders and Pistons.*



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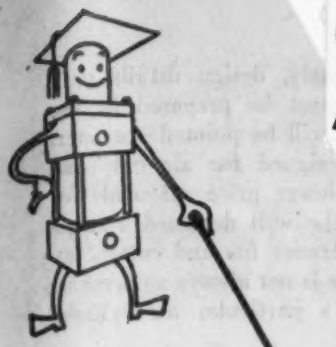
Miller

# FLUID PRESSURE BOOSTERS



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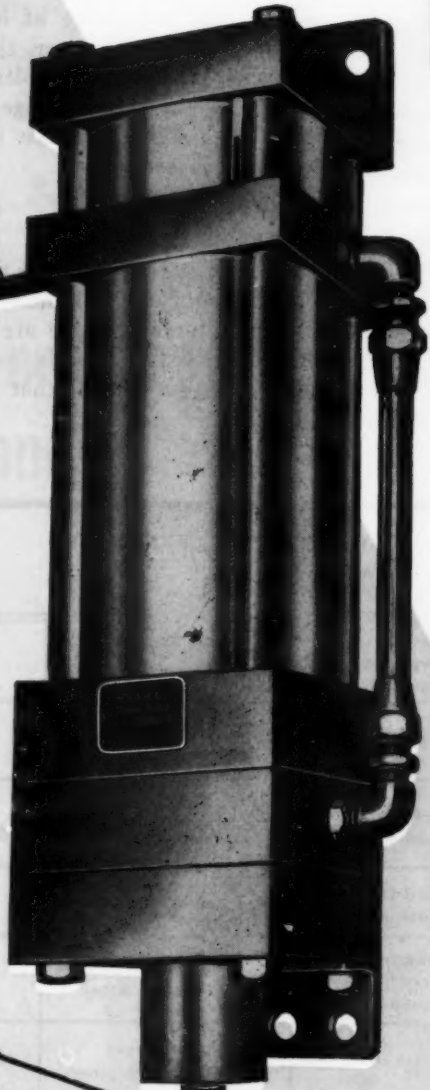
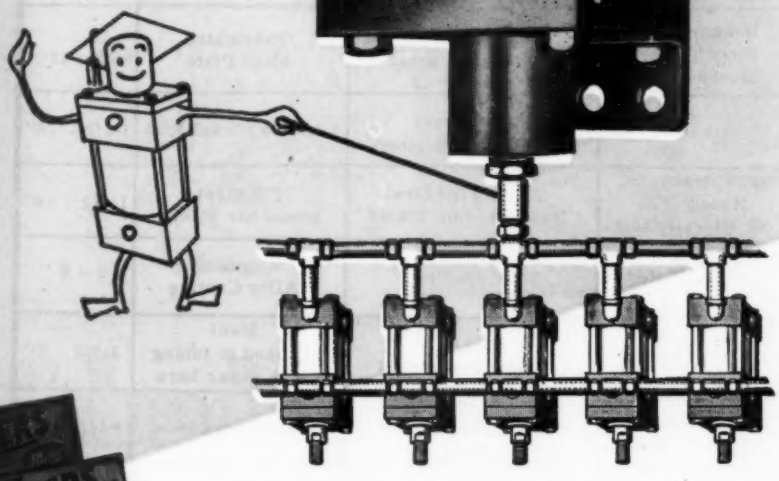
## TO 2000 PSI HYDRAULIC PRESSURE

**Output Range: 200 to 10,000 psi Fluid**





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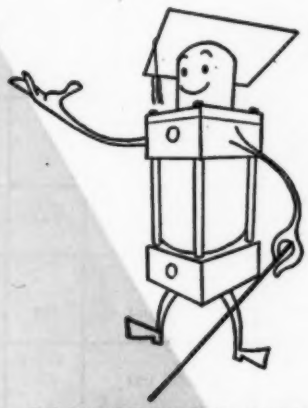

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## . . . air cylinder selection factors include speed, load, space . . .

designate materials of cylinder parts and types of packings used and list mounting types available.

As an introduction to the use of published specifications of air cylinder manufacturers, we have charted data usually given in specifications of leading manufacturers of air cylinders. Table 1 covers part of these data. Table 2, to be included in the next installment, completes the composite specifications.

***Service*** By far the larger number of air cylinders are double acting. Low pressure cylinders may be designated for air operation only, for dual purpose (air or oil) or for general purpose use (air, water or oil). Obviously, design details vary where the same cylinder must be prepared to use fluids other than air. These will be pointed out later. In general, the cylinder designed for air only can usually take advantage of lower price materials for tubes and caps. However, the well designed air cylinder will require close tolerance fits and careful assembly so that the cost range is not always an accurate index to the performance a particular air cylinder will give in service.

***Operating Pressures*** Cylinders designed for air service alone have recommended operating pressures that average about 150 psi. On dual purpose cylinders, recommended operating pressures for oil service are usually listed separately. When a cylinder is to be used for water service, the pressure approximates that recommended for oil. In

AIR CYLINDERS, COMPOSITE SPECIFICATIONS

TABLE 1

| MFR. | S/D ACT. | SERVICE | OP. PRESS | TIE RODS | TUBE | PISTON | CAPS | SIZES |
|---|---|---|---|---|---|---|---|---|
| 1 | DA | A-W-O | To 150 psi | Yes | Hard Drawn Seamless Brass | Steel (chrome plated for water service) | Iron Alloy | 1-1/2 - 14" |
| 2 | DA | A-W-O | To 110 psi | Yes | Brass | Steel Ground & Polished | | 2 - 14" |
| 3 | DA | Air | To 150 psi, Air | Yes | Steel Tubing, Bored & Honed | Steel Ground & Polished | High Tensile Semi-Steel Alloy | 3 - 12" |
| 4 | DA | A-W-O | To 400 psi | Yes | Hard Drawn Bronze | Steel | Semi-Steel Moly Alloyed | 2 - 8" |
| 5 | DA | Air | To 150 psi | No | Seamless Steel Tubing, Honed | High Tensile Aluminum Alloy | Fabricated Steel Plate | 2 - 12" |
| 6 | DA | Air | To 150 psi | Yes | Brass | Alloy Steel Ground & Polished | Chrome Nickel Iron | 1-1/2 - 16" |
| 7 | Both | Air | To 200 psi | Yes | Hard Brass, Honed (10 Microinches) | Fabricated Steel Hard Chrome Plated | CR Steel (from bar stock) | 1-1/2 - 14" |
| 8 | SA | A-W-O | To 250 psi, Air | No | Brass, Plated | Stainless Steel | Aluminum Alloy Casting | 2 - 6 " |
| 9 | DA | A-W-O | To 150 psi, Air To 500 psi, Oil | No | Steel, Honed | Steel Ground & Polished | Steel Locked to tubing with shear bars | 1-1/2 - 8" |
| 10 | DA | Air | To 110 psi | Yes | Cold Drawn Brass Tubing | High Carbon Steel Ground to Close Tolerances | Fine Gray Iron | 1-1/2 - 14" |
| 11 | DA | Air-Oil | To 150 psi, Air To 300 psi, Oil | No | | Alloy Steel Rod Oversize Ground & Polished | Heavy Duty Alloy Bored to fit turned diameter on tube | 1-1/2 - 12" |
| 12 | DA | Air | To 100 psi | Yes | Honed & Hard Chrome Plated | Hard Chrome Plated Metal to Metal Type | | 1-1/2 - 14" |
| 13 | DA | Air | To 200 psi | No | Brass or Steel | CR Steel or Stainless Steel | Aluminum Corrosion Resistant | 1-1/2 - 10" |
| 14 | DA | Air-Oil | To 200 psi, Air To 500 psi, Oil | Yes | Hard Brass (hard chrome plating available) | Cast Iron Alloy | | 1-1/2 - 12" |

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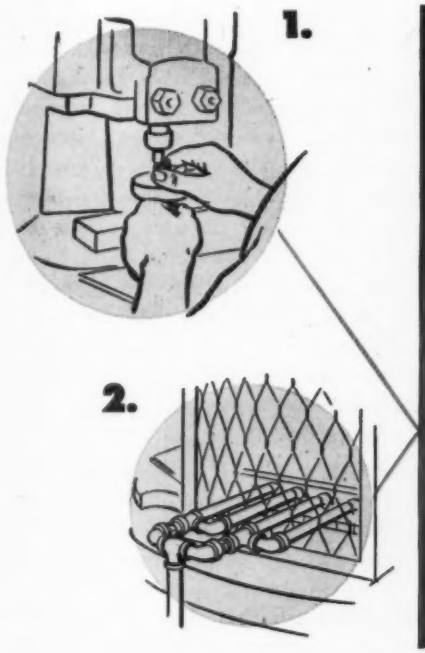


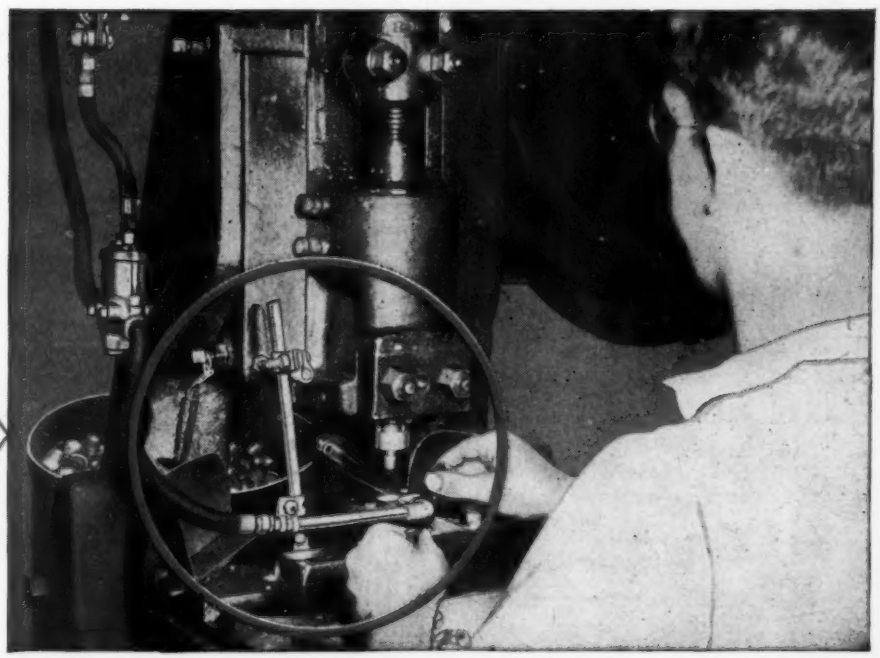

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Circle 90 on Reader Service Card

**. . . variations in material and construction are reflected in type of service and cost . . .**

some cases one recommended operating pressure for any fluid is specified. It should be noted that recommended pressures will sometimes vary with diameter

---

### J.I.C. Pneumatic Standards

*Reprinted here is the section of the Joint Industry Conference Standards applying to the design of pneumatic cylinders. Established in* 1950 *the purpose of the standards is to provide air powered machines which are easy to maintain and safe in operation.*

Cylinders and Pistons section A6.3

A6.6.1 Cylinder bores having fitted pistons shall be finished in a manner consistent with the type of service intended and shall be free of porosity or other defects.

A6.3.2 Cylinders shall be located in alignment with work slides and shall be such that no radial load shall occur on piston rod or ram, unless suitable provisions are made to take such loads.

A6.3.3 Ends of cylinders shall utilize sealing devices that do not leak under manufacturer's intended operating conditions. Cylinder external sealing devices shall be readily accessible for servicing.

A6.3.4 (a) Cylinders shall be accessible for servicing.

(b) Cylinders shall be separate, not cast integral with equipment.

A6.3.6 Piston rods shall be adequately protected by installation of cleaning and sealing devices. Material and hardness of piston rod shall be such as to prevent scoring.

A6.3.7 When piston is assembled to rod they shall be positively locked.

A6.3.8 When necessary, cushions shall be provided on cylinder ends.

---

sizes, lower pressures being recommended for larger sizes. Should there be any doubt, the manufacturer or his representative should be consulted.

***Tube*** Air cylinder tubes or bodies are commonly made of brass, normally hard drawn and honed. Tubes are plated, usually hard chrome, for dual or general service. Steel tubing, bored and honed, is used for air service cylinders by several manufacturers and for dual or general service. Manufacturer's facilities in some cases make some exceptions necessary. For example, one manufacturer hones and hard chrome plates tubes up to 12 inches in diameter, and on larger sizes and on longer strokes, bores and hones cast bronze tubing. Cost is a factor also.

***Tie Rods*** Tie rod designs are used by a majority of air cylinder manufacturers. The presence or absence of tie rods seems to be a factor in the design thinking of manufacturers rather than a matter of quality or of a price range. Modern tie rod air cylinders do not suffer in comparison with no-tie rod designs in most applications where space is not a factor. The choice depends more on the individual taste of the user, his special application problems and the ability of a specific cylinder to meet them.

***Piston*** Piston rods for air cylinders are made of a variety of materials. Some are of cast iron alloys, others are of high tensile aluminum alloys. The majority, however, are of various steels —cold rolled, high carbon, stainless and various alloys. Rods are almost always ground and polished. Grinding to close tolerances and polishing to mirror finishes are factors which make for low friction and long, efficient operating life. For dual purpose or general service use, polishing, plating and the use of corrosion resistant alloys or stainless steel are utilized.

***Caps*** End caps or heads on air cylinders are fitted much the same way as caps on hydraulic cylinders. They may be bolted to flanges, screwed to the body, held by tie rods, internal keys, snap or retainer rings. Many caps are interchangeable; most are rotatable for convenience in porting. In some designs, intake and exhaust control valves, bleeders and cushion adjustments are located in the caps. In one design the cylinder body is piloted into the caps; in another the cap contains the mounting pads integrally.

While caps are the heaviest parts of air cylinders and must not leak (J.I.C. Pneumatic Standards for Industrial Equipment, section A6.3.3), they also must be readily disassembled for packing service or piston replacement, whenever possible without removing the cylinder body from its mounting.

Materials from which caps are made often will differ from that of other parts of a cylinder. Such materials include aluminum alloy castings, gray iron, high tensile cast iron, chrome nickel iron and semi-steel alloy.

Materials are important in that their choice, both for individual parts of a cylinder and in their collective assembly, are design selections, based upon experience, to give trouble free service life and efficient, low cost operation.

***Sizes*** The bore sizes for commercially available air cylinders run from 1½ to 16 inches, with most manufacturers offering complete stock lines in sizes from 3 to 10 or 12 inches. As far as can be determined, most air cylinders used for industrial applications are in the 3 to 8 inch range. While manufacturers build extra long stroke cylinders to order, this is an expensive procedure. By calculating the cylinder stroke as closely as possible to the required movement, air is saved and usually a standard stroke cylinder can be selected.

*The next installment will complete a discussion of the composite specifications of air cylinders.*



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# HOW UNITED STATES STEEL CORPORATION USES LINDBERG HYDRAULIC CYLINDERS

U. S. Steel had a special job to do. Huge, heavy coils of sheet steel . . some of them, 4' in diameter and 6' high, weighing up to 25,000 lbs . . had to be pushed, tilted, and pulled for positioning on a system of gravity conveyors leading to the entry end of the pickle line.

A special Lindberg Hydraulic Cylinder installation was designed to handle this "special" job. It consisted of seven king size Lindberg Cylinders, including one of the longest stroke, single piece cylinders ever built . . 8" by 288". From the storage area, over the conveyor system, to the entry end of the pickle line, Lindberg Hydraulic Cylinders handled the job . . safely and dependably.

U. S. Steel is but one of the many companies who are using Lindberg Cylinders on tough applications that call for special engineering.

If yours is one of those "almost impossible" jobs, make arrangements to talk with a Lindberg Air and Hydraulic Cylinder Engineer. They're "special cylinder specialists" . . eager to work with you on the design of any special cylinder installation.

**LINDBERG** AIR . . HYDRAULIC CYLINDERS

Lindberg Engineering Company, 2450 West Hubbard Street, Chicago 12, Illinois

## You can register now for October meetings of the . . .

# National Conference on Industrial Hydraulics

ENGINEERS from industries throughout the country will attend the ninth National Conference on Industrial Hydraulics in Chicago on October 8 and 9. The Illinois Institute of Technology and the ten other sponsoring technical societies will be hosts at the Sheraton Hotel for this technical program.

### *Growth in Attendance*

These meetings, which have been held since 1945, are the only national sessions discussing oil hydraulic developments. During these years, the conference has grown in scope and has become an important meeting place for hydraulic designers and manufacturers.

The list of papers, given below, is scheduled for the October meetings. Speakers will present papers discussing the work being done by the staffs at companies which include Chrysler, E. W. Bliss, Watson-Stillman, Allis-Chalmers, General Electric, Bendix Aviation, Caterpillar Tractor, Sealol Corporation, The Oilgear Company, General Motors, and Vickers, Inc.

These papers will be presented at nine different sessions: general, automotive, presses, pumps, components, machine tools, non-flammable fluids, tractors and instrumentation. Each session will be followed by a panel discussion on individual papers and questions from the floor will be discussed by the speakers.

To fit the extensive program into two days, several sessions will be held concurrently. Many companies desiring a complete report on all sessions send several members of their engineering staff.

An evening dinner meeting and the regular luncheons provide an excellent opportunity for informal discussion between engineers from different cities and industries. Many manufacturers of hydraulic components will have exhibits set-up in the hotel during the two day conference.

### *Where to Write*

Hotel reservations are being made now, and your registration for the conference can be arranged by writing to John G. Duba, Conference Secretary, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, Chicago 18, Illinois.

## The papers you'll hear cover many fields of application . . .

"Friction and Wear Phenomena"

"Hydraulics Applied to the Automobile Suspension"

"Hydraulic Mechanisms for Operating Auto-Window Lifts, Convertible Tops, and Similar Mechanisms"

"Hydraulic Problems on Large Forging Presses"

"Self Contained Pump Units as Applied to Extrusion Presses"

"Ball Piston Pumps and Motors"

"Aircraft Variable Delivery High Pressure Fuel Plunger Pump"

"Fluid Carriers for Hydraulic Units in Earth Moving Equipment"

"Factors in Design of Mechanical Seals and Applications to Hydraulic Equipment"

"Hydraulically Operated Test Table with Three Degrees of Freedom"

"Hydraulic Applications in Paper and Paper Processing"

"Industrial Application of Non-Flammable Hydraulic Fluids"

"The Effect of Synthetic Fluids on Hydraulic Components and Circuits"

"Hydraulic System of the Golden Jubilee Ford Tractor"

"Hydraulic Actuation of the TD-24"

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RACINE "Variable Volume" Pumps eliminate relief valves and extra piping. They reduce horsepower requirements and avoid excessive heat losses. Over-all cost of motor and reservoir is usually reduced. Efficiency is high because RACINE Pumps "put all of the oil to work."

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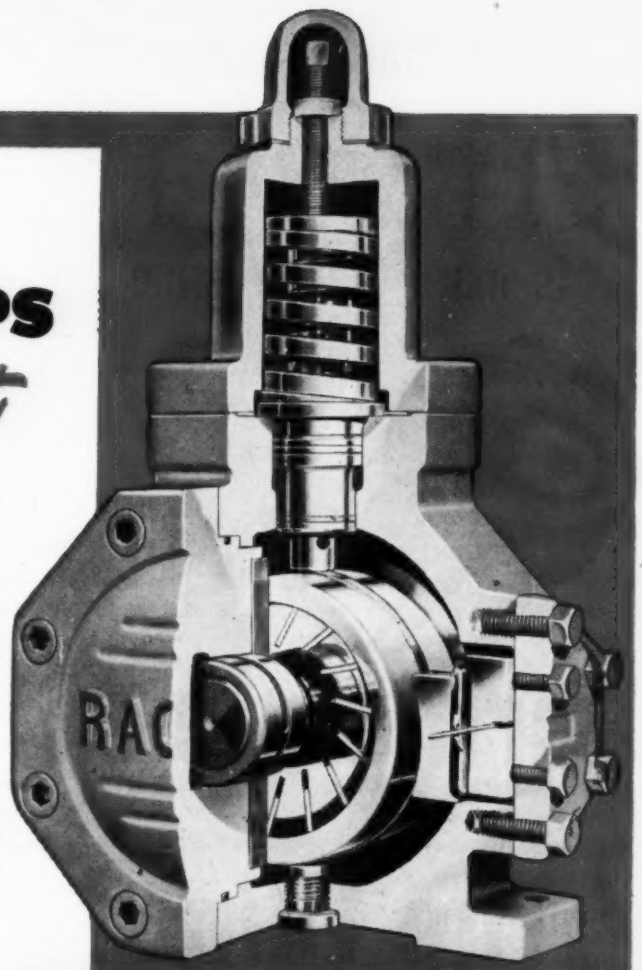
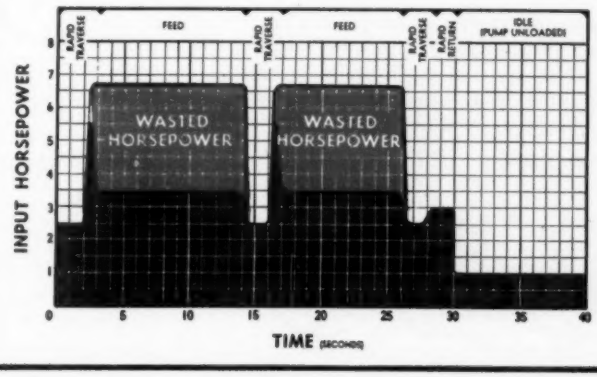


*Chart below illustrates power consumption on a typical machine tool. Black area is power used with a No. 2* RACINE *"Variable Volume" pump controlled by a pressure compensated feed valve. Area in color is power wasted by a constant volume pump, bypassing most of its volume through a relief valve during the feeding cycle.*

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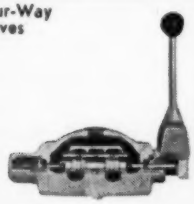
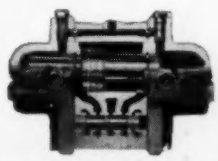


Pressure Boosters



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Gerotor hydraulic pumps are engineered for pressures up to 1000 p.s.i. continuous duty; in some sizes, up to 1200 p.s.i. continuous and 1500 intermittent. Deliveries range from .4 g.p.m. at 1800 r.p.m. to 40 g.p.m. at 1200 r.p.m. Plain, base or flange mounting. Write for pump catalog.

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hydraulic pumps & motors

# Air Power Handles Mixer

Continued from page 57

storage bin is opened and closed by a double roller clamp (Figure 2). The roller clamp is opened and closed on the throat of the boot by the scissors action of a pair of toggle arms actuated by a vertically mounted, double acting air cylinder whose rod rides on a cam on the toggle axle. A vibrator on the long slope of the bin insures that cement will drop into the canvas boot. The vibrator operates when the canvas boot is open. It can also be operated independently at other times. A transfer chute below the boot leads to the weighing bin.

## *Valves Operate from Central Panel*

The sand and aggregate is dropped from the storage bins to the weighing bins by the opening and closing of clam shell gates operated by air cylinders (Figure 3), mounted horizontally at the upper floor level. Three such bins are provided on each side, one serving two mixers, the other a single mixer. The 2 inch bore cylinder is operated by 4-way, two-position, manual valves with spring return. The same type of valve is used for all cylinder operations in the plant proper. All valves are mounted on the central control panels.

The weighing bins, one on each side, are at the next lower level. The correct weight of each ingredient of each load mix is controlled by the operator at the control board. He watches a scale on his board and cuts off the cement, sand or aggregate flow by operating the proper valve, closing the roller clamp or clam-shell gate as the case may be.

On the side which serves two mixers, two feed chutes between the weighing bin and the mixers have a common outlet into which a flop valve is fitted so that the charge may be diverted to one of the mixers. This flop valve is operated by an actuating arm, clevis attached to the rod of a 2 inch bore cylinder. This cylinder (Figure 4) is horizontally mounted at the floor level of the weighing bin.

## *Two Lines, Two Control Panels*

On the next lower level are located the mixers and the central control stations. Controls for one side of the plant are shown on Figure 5. The other board, facing the one shown, operates the other line. Every cylinder in the plant, except the truck dump cylinder, is operated from these boards. One operator can on occasion operate both boards. With peak operation, two operators are required.

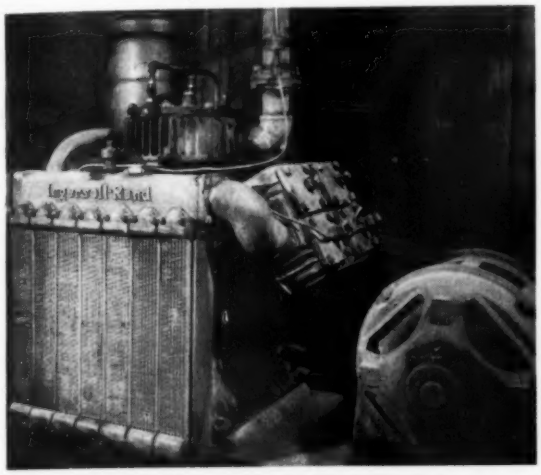
Orders for specific yards and mixes comes to the operator on a telewriter from the first floor office. We have followed loads to the weighing station. The operator then dumps the loads into the proper mixer, then adds water by weight. Inverted gate water valves are operated by air cylinders. A dial, shown at extreme left in Figure 5, permits the operator to add water accurately.

A separate system is provided for adding calcium chloride in solution form to the mix. The calcium chloride is agitated by air pressure for quick, even

dissolving. It is piped to two dispensers or reservoirs from which it flows into the mixer; the amount, normally two percent by weight of cement, is controlled by a timer on the control board.

After a short mix the load is ready to dump. Eight inch, trunnion mounted air cylinders, integral with the original equipment, are operated by two position valves (large levers on lower row of panel, Figure 5) to dump the mix into the holding bin.

The holding bin is immediately above the truck



**8. A VERTICAL, single acting, two-stage, air cooled, multiple V-belt compressor, driven by a 75 hp electric motor, operates all the air services in the plant and yard.**

loading area. When the mix is in the holding bin, the driver, who has placed his truck in place for the load, operates the manual dump valve, located on the outside side wall of the truck drive-through. This actuates vertically mounted dump cylinder (Figure 6) which pulls a large cylindrical plug out of the base of the holding bin, dumping the load into his truck (Figure 7).

Air for the entire plant—of which the cylinders described use only a small part—is supplied by a vertical, single acting, two-stage, air cooled, multiple V-belt compressor driven by a 75 hp electric motor. This unit delivers 445 cfm free air and has a piston displacement of 360 cfm.

### *Maintenance Record*

Aside from rusting of solenoids in the humid atmosphere in the tunnel and some caking of cement dust on pistons, requiring solenoid replacements and renewed packings, the air system has given excellent service. Good plant preventive maintenance has resulted in three years of hard service without any breakdowns due to application or functioning of any of the air components. Average daily outputs of 700 to 800 cubic yards under extremes of seasonal temperatures and adverse atmospheric conditions have been maintained with heavy days when over 1400 cubic yards have been mixed and delivered in 8 hours.

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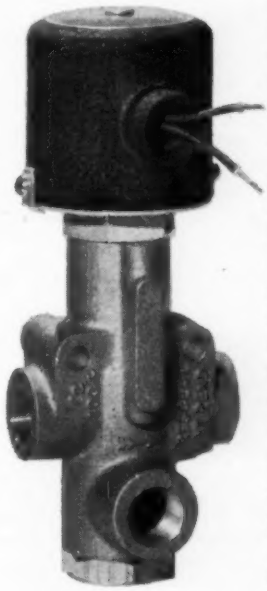

model 1034 3-way valve

The production minded O. E. M. will recognize, at a glance, that Crescent Valves are designed for volume production; that's why the price is low and the delivery prompt.

The sales minded O. E. M. will appreciate the extreme flexibility of Crescent Valves. They can be converted to practically any AC or DC voltage by simply changing coils. Sales and service are handled by a national organization represented in every major trading area by competent field engineers.

*Crescent Solenoid Operated, Pilot Controlled, 3-Way and 4-Way Valves for air, water, and light oil service. Sizes 1/4", 3/8", 1/2", and 3/4". Pressures to 500 P. S. I.

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AIR AND HYDRAULIC
Control Valves

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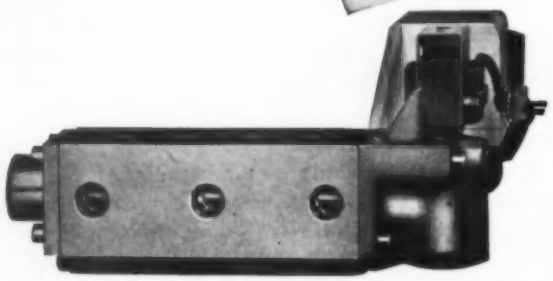

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● Quick-As-Wink Solenoid Valves are unsurpassed for positive, trouble-free dependable service . . . they give users millions of cycles of fast, high speed — and safe — operation. All parts are rugged. Low amperage requirement of the solenoid eliminates intermediate relays and simplifies electrical circuits. ⅜" to 2" sizes. 2-way, 3-way or 4-way actions. Bucking cylinder or double solenoid return. Send for the data sheets. Get full details about Quick-As-Wink, America's outstanding valve line, today.

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Push-pull or push and spring return operation — ⅛" and ¼" tapped connections. Widely used for controlling cylinders and many other applications. Air to 125 psi — vacuum—can also be used in low pressure hydraulic service.

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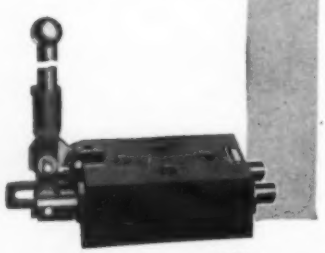

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# Air-Oil Booster Circuit

Continued from page 62

overrides its roller follower on the return stroke, the index lock bar being returned to the lock position by spring action. The rocker shaft, through a system of links, rack and pinion, pawl housing and ratchet, also revolves the work holding fixture.

## *Sequence Interlock*

In order to safeguard against careless or improper operation of the controls and to insure that the work cylinder cannot operate while the work fixture is being indexed or that the fixture cannot be revolved while the work cylinder is under pressure, an interlock bar is mounted across the rear of the base plate. This bar is operated by the lever to the left of the operator and has two slots which register at either end of its stroke with a sliding finger linked to the control valve in use. By this means, one valve must be closed before the other can operate. The power control valve (valve No. 1) for the work cylinder is located nearest the operator at his right. The outer valve (valve No. 2) controls the latching and rotation of the work holding fixture.

The operator places the work in the die, moves handle of valve No. 1, air passes to both the oil reservoir on the booster and to the top of the air piston in the booster. However, because of the restriction setup by the flow control valve, the cylinder three-way valve is delayed in opening long enough to have the air to the oil reservoir on the booster force the oil through the low pressure by-pass line into the work cylinder to actuate the advanced stroke of the work cylinder. By this time the cylinder valve has opened and air forces the air piston ram into the low pressure oil to boost it to the final high pressure. The operator then reverses the handle of valve No. 1. This admits air to the separate oil reservoir to return the work cylinder and to the underside of the air piston in the booster to return the piston to the starting position. When zero position is reached, the operator moves the safety device (interlock bar) handle, and the handle of valve No. 2 which operates the air cylinder to position the fixture for stamping the next work piece.

## *Frame Construction*

The highly stressed members of the machine—base plate, work cylinder support plate, support columns, work fixture, upper and lower die holders and retaining nuts are all made of high alloy steel, heat treated for maximum strength. All wear points are provided with ample bearing surfaces; parts are machined from tool steel, properly heat treated for the services required. Adequate lubrication facilities are provided so that minimum wear and long working life may be realized.

The shop air is put through combination filter-lubricator units before admission to the machine circuits; pressure is regulated by reducing valves;



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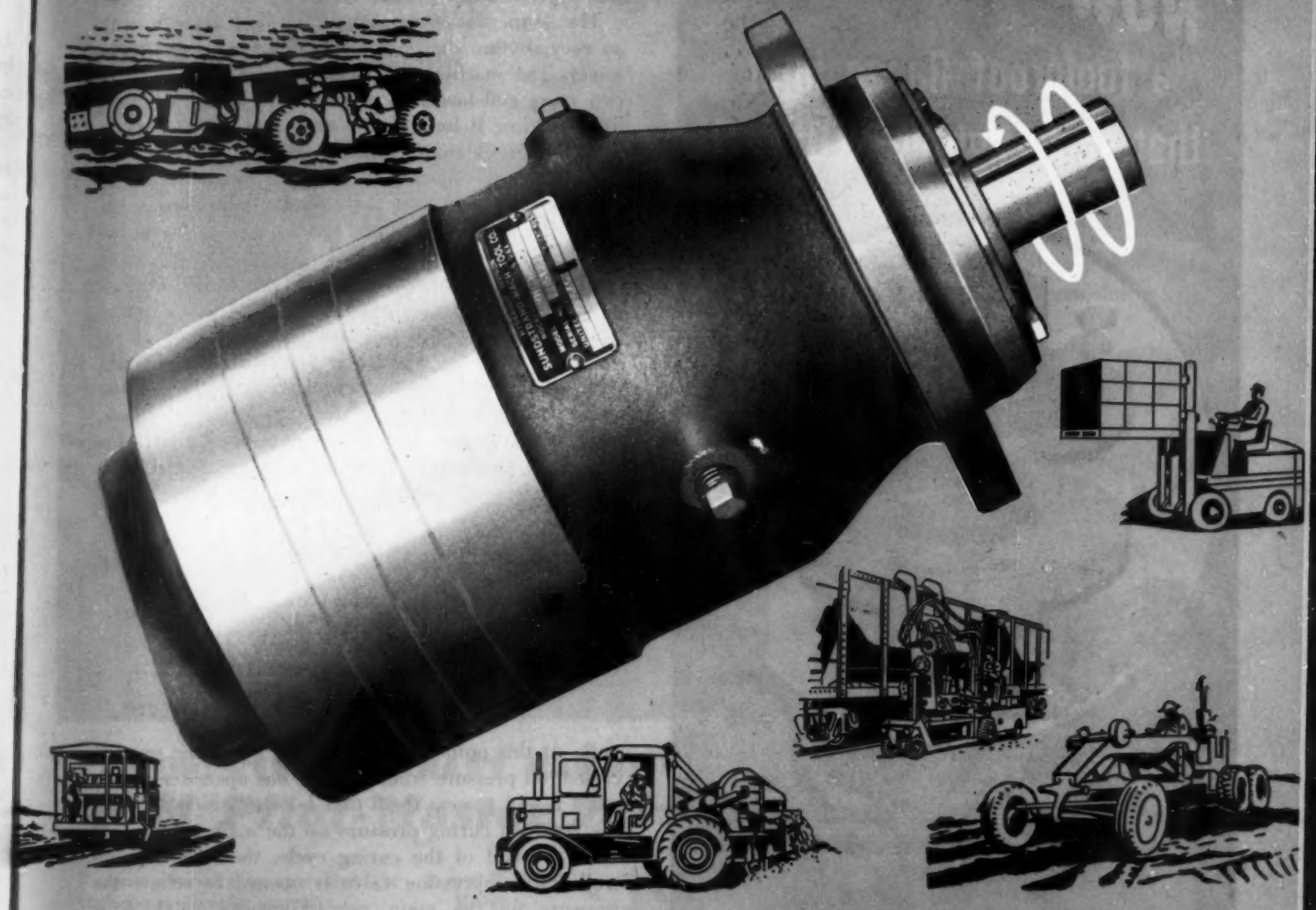
# SUNDSTRAND



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It gives you information on application, operation, performance, models, and mounting arrangements of Sundstrand Fluid Motors. Form No. 113-2.

• Sundstrand Fluid Motors provide driving power by converting pressurized oil to rotary motion through a simple wobbler—piston arrangement. With one of these motors as a source of power, you can eliminate complicated mechanical-type transmissions, which are highly subject to wear and require considerable maintenance. Because the fluid motor is so compact, it can be mounted close to the driven member. This does away with gears, clutches, belts, chains, and long shafting. Windup, which is experienced with mechanical-type drives, is no longer a problem. The driven member receives the full force delivered by the high torque motor. Speeds can be controlled infinitely over the complete range without clutching or changing gears.

Sundstrand Fluid Motors are simple in design . . . built to withstand rugged treatment. The wobbler is the only rotating part. It is dynamically balanced to assure smooth operation and keep maintenance low. Models range in output from 13.65 hp to 30.00 hp at 1000 psi and 1800 rpm. If you have a power transmission problem, a Sundstrand Fluid Motor may be the answer. Write or phone for details.

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Precision-moulded Linear O-Rings are supplied in silicone and many other natural and synthetic rubbers. Write or call Linear for full data.

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

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mufflers keep the machine quiet in operation. The work stroke is in the nature of a silent squeeze with stamp penetration of .010 inch.

The sequence of operations is very smooth with an easy rhythm that keeps operator fatigue at a minimum. The machine has been in operation for over two years and has been practically trouble free. During this time it has been cleaned and adjusted twice as a matter of routine maintenance.

Although the machine is rated at twenty tons, experience has been that the average requirement has been fifteen or sixteen tons, leaving a good margin in reserve.

The yearly saving in stamp cost, due to the accurate alignment and precise positioning, has been approximately 25 percent of the entire original cost of the machine, while the gain in production has been over 600 percent, with a minimum of operator fatigue. For short runs, where the operator can endure the pace, considerably higher production may be attained. The press can easily cope with all present requirements and has ample capacity to meet any foreseeable demands.

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# Oil Temperature Control

Concluded from page 55

tank. At this point in the operating cycle, the press is closed, oil pressure from pump L has opened sequence valve B and powers the 3 to 1 booster which develops the 2000 psi curing pressure on the main ram.

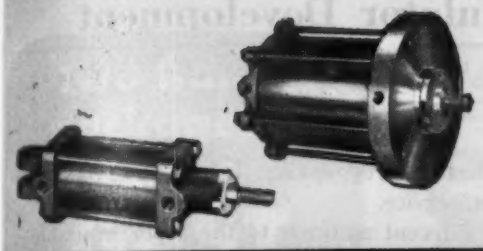
At the end of the curing cycle, the solenoid controlled decompression valve is opened to relieve the pressure on the main ram. Four-way valve A is reversed, unloading valve J will close off and both pumps, K and L, will deliver oil to open the press.

## *Oil Cooler Capacity*

During idle time, when the press is held open, 4-way valve A is in neutral and the pump volumes are circulating through the neutral position porting back to tank. The circuit is arranged to divide the pump flow — half of the flow going through the heat exchanger and the other half dumping to tank at 50 psi drop through valve V. This arrangement provides sufficient oil cooling and makes it possible to use an oil cooler having a capacity of only 20 gpm.

At one time during the preliminary design, a separate pump to circulate the oil for continuous cooling was considered. This approach was not necessary and would have been undesirable from the standpoint of space and cost.

It was not found necessary to include temperature regulating controls on the hydraulic system of these presses. The use of variable volume pumps taking oil from a large reservoir, the arrangement of an unloading circuit, the application of an oil cooler and the provision for maximum heat dissipation through radiation have resulted in press operation at a safe oil temperature not exceeding 130F.



## Pneumatic Cylinders

Really complete, the Hannifin line of pneumatic cylinders is made with two types of pistons . . . bores from 1" to 16" . . . six standard mountings. Really standard, these cylinders are tooled to tolerances that assure accurate mounting to make assembly to your machines easier. Really built, each cylinder is "TRU-BORED" and honed, piston rods are ground and polished, interchangeable end caps, heavy duty tie rods . . . rugged, yet precision construction throughout!

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## HANNIFIN HAS THE MOST COMPLETE LINE OF AIR CONTROL EQUIPMENT!

## NEW! REVOLUTIONARY HANNIFIN *P-M Pilot-Master Valves*

Piston-operated poppet design. Exclusive replaceable cartridge for easier maintenance. Speeds to 600 cycles per minute. Pressure from 15 to 150 p.s.i. Integral, solenoid-controlled pilot heads or a choice of 10 separate pilot valves for remote control.

- Fewer Valves to Stock
- Fewer Parts to Stock
- Maximum Interchangeability
- No Springs in Main Valve

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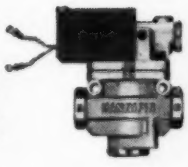

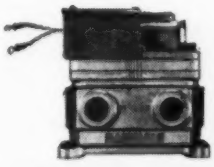

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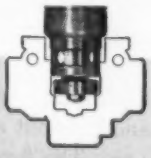

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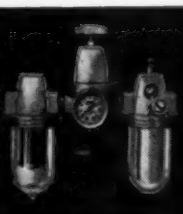

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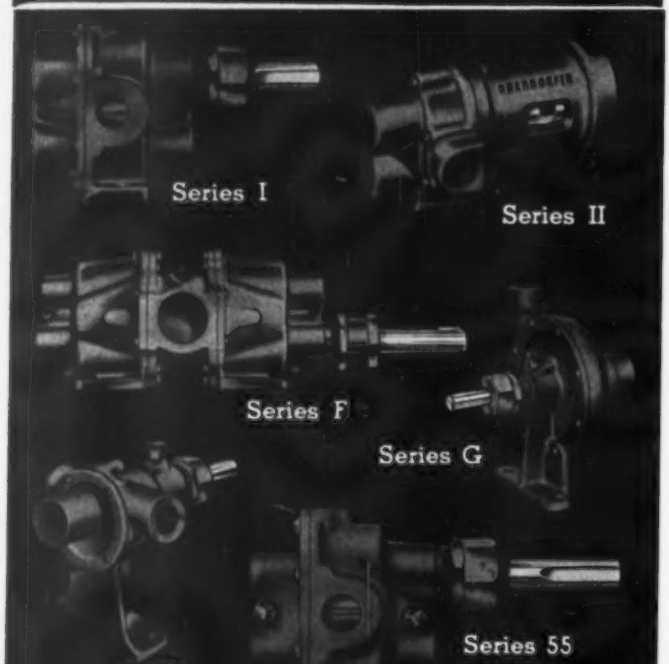


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# Accumulator Development

Concluded from page 60

systems for heavy earth moving, bus and automotive passenger car service.

A relatively recent addition to the types available is the double shell piston cylindrical accumulator. This type is believed to have certain advantages for the larger capacities as may be required in the industrial or commercial fields. The advantages of the double shell as compared to the single shell may be summarized: (1) the outer shell, being required to perform only as a container for the pre-charge gas and the inner shell sub-assembly, piston and external hydraulic fitting, can be produced by standard fabrication methods comparable to relatively low cost type of gas bottles; (2) the outer shell absorbs external damage; (3) the inner shell is pressure balanced when the unit is in operation—the "O" ring squeezes and piston clearances remain constant through the variations of pressure operation; (4) compression ratios may be varied by the use of inner shells of different OD and wall thickness with corresponding pistons to suit an operating requirement; (5) the inner shell is fabricated from cold drawn conventional steel tubing, honed, chromed and bonded or "O" ring sealed to the external hydraulic fitting; (6) by taking advantage of most of the operations in the manufacture of standard hydraulic cylinders, the overall cost is kept low.

Figure 5 is a diagrammatic sketch of a typical double shell piston accumulator. At least one such unit, tested by an independent laboratory, has passed all specified tests of MIL-A-5498, Type II with less than the specified minimum of leakage of gas and hydraulic fluid past the "O" rings. This type, while it meets aircraft performance specifications, is well adapted to many industrial applications.

## *Engine Cranking Application*

Figure 6 diagrams a circuit in which this type accumulator is used for cranking. This is a closed circuit accumulator-unloading valve system. The unloading valve is normally closed; the pump charges the accumulator until at a desired pressure the unloading valve opens and the pump flow is by-passed to reservoir. When the accumulator pressure drops approximately 300 psi below the cut out pressure, the unloading valve "cuts in" the pump to recharge the accumulator.

The pump delivers 5-6 gpm at 3000 psi; the unloading valve cuts in at 2700 psi and cuts out at 3000 psi. The relief valve is set at 3300 psi. The flow regulator is set for desired steady flow condition at motor for constant speed of plus or minus 10 percent. The metering device is set either for a specified length of "shot" or left for complete discharge of the accumulator. For example, cranking runs with the 5 gallon accumulator can be metered for three shots of 8 seconds each, two shots of 5 seconds each or one shot of 10 seconds.

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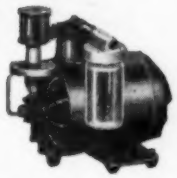

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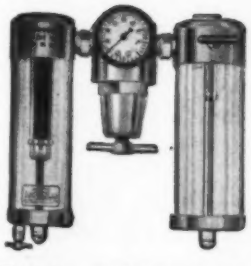

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# Development of "O" Rings for Aircraft Applications

By Frank S. Straus

ROUND cross section packings or "O" rings were used to a limited degree in the hydraulic systems of military aircraft prior to 1940. These were not the first "O" rings. As early as the middle of the nineteenth century solid cast iron "O" rings were used to seal steam engine cylinders. Modern "O" ring development was made possible by the development and use of suitable oil resistant rubbers. The application of synthetic rubber "O" rings in hydraulic systems received their first real application opportunity in our service aircraft. The first "O" rings were used in a petroleum base hydraulic fluid (A.A.F. 3580). Early models of the B-17 and B-25 are examples of aircraft which utilized some "O" ring packings in an era when V-ring packings were predominant.


*FRANK S. STRAUS, Aircraft Laboratory, Wright Air Development Center, Wright-Patterson AFB.*


Some of the early aircraft "O" rings had large cross-sections when compared to the standard "O" rings of today. The "O" rings were usually installed in a round bottom groove (Figure 1). About 1941 Mr. N. A. Christensen brought his patented "O" ring idea to the attention of the Air Corps at Wright Field, Dayton, Ohio. His idea was to use a round cross-section rubber ring in a rectangular groove of larger cross-section than the cross-section of the "O" ring and to depend upon an initial diametral squeeze of the "O" ring for sealing at low pressure.

Just how this principle works may be illustrated with an example. Figure 2 shows the relation of a typical "O" ring installed in a rectangular groove. When the groove diameter A, the bore diameter B and the "O" ring free cross-sectional diameters are known, both maximum and minimum squeezes may be calculated

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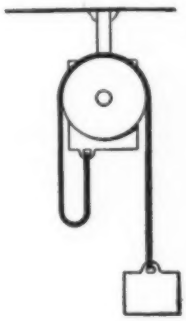

### here's one example

**Suspension of the load on a chain hoist.** The load is lifted or lowered by the rotation of the sprocket. One end of the chain is permanently anchored as indicated. The free end is fastened to the object to be lifted or lowered. The sprocket is driven by hand power or motor power through gearing. The slack side of the chain usually hangs freely, thus providing 180° wrap on the sprocket.

### here's another one

**Reposition of a shaft that has been rotated through a limited angle.** The shaft is turned clockwise (as shown in the illustration) during some operation of the associated equipment. The resulting compression of the spring provides the energy necessary to return the shaft to its original position. In many cases of this type, operation is frequent and high shock loads are encountered, so *chain* is the answer.

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***This year is the 50th anniversary of powered flight. Last month AH included a short article telling about plans for several articles which detail the development of aircraft hydraulic and pneumatic components. Frank Straus' "O" ring article is the first of this "anniversary group".***

for a piston head seal by using values with applicable tolerances.

For example:

When cylinder bore B = 1.251 in ±.001
piston groove A = 1.007 in ±.001
"O" ring cross-section d = .139 in ±.003

$$\text{Nominal squeeze} = \frac{.139 - 1.251 - 1.007}{2} = .017 \text{ in}$$

$$\text{Minimum squeeze} = \frac{.136 - 1.252 - 1.006}{2} = .013 \text{ in}$$

$$\text{Maximum squeeze} = \frac{.142 - 1.250 - 1.008}{2} = .021 \text{ in}$$

The increased use of "O" rings during 1941 dictated a need for some control of the shapes and sizes of "O" rings, as well as installation details, in order to prevent a tremendous stocking problem. An analysis of individual standards used by aircraft manufacturers, aircraft accessory manufacturers and "O" ring manufacturers indicated that most companies were in close agreement on the use of the new packings, but in each case a slight difference in nominal size, installation procedures, tolerances and number of standard rings existed.

A study indicated that the problem of designating a list of standard size round cross-section packing rings could be broken down as follows:

(a) Sizes of standard "O" rings to be such that nominal cylinder bores and piston rods based on S.A.E. and Army-Navy conferences can be used on all designs. The range of sizes to be comparable with the nominal I.D. of V-ring packings as set forth in existing S.A.E. and Army-Navy specifications. This condition assumes that no packing ring will normally be stretched to fit more than one diameter groove.

(b) Tolerances be such that differences in squeezes on the cross-section of the "O" ring caused by these tolerances be a minimum, and be consistent with good manufacturing and molding practices.

(c) The squeeze on the cross-section of the "O" ring be as low as possible to give minimum friction, but compatible with the requirements of wear on the packing and bulge of an actuating cylinder barrel under pressure.

(d) The cross-section of the packings be as small as possible and still be compatible with the stresses caused by squeeze.

A table was prepared by the Air Corps (now Wright Air Development Center, Air Research and Development Command, Wright-Patterson AFB) to define nominal gland sizes, gland dimensions and actual "O" ring packing sizes. This table was presented to members of the aircraft industry at an informal meeting in January, 1942 and to industry at the first S.A.E. A-6 Committee meeting the same month. As a result, drawings AN 6227 and AN 6230, listing standard "O" rings was issued in April, 1942.

"O" ring hydraulic packings as typified by Air Force-Navy drawings AN 6227 and AN 6230 are synthetic rubber compounds conforming to packing Specification MIL-P-5516. "O" rings used in the hydraulic systems of military aircraft must perform through the temperature range of –65 F to 160 F, and only compounds which are tested and conform to Specification MIL-P-5516 are approved for military aircraft. The

**FIG. 1. AN EARLY round bottom groove for "O" rings. The width is slightly more than twice the depth.**

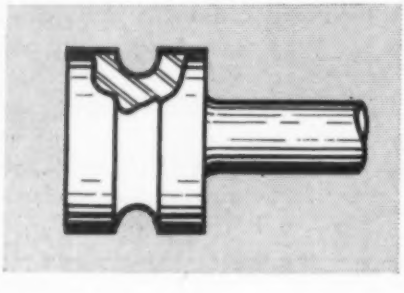


**FIG. 2. RECTANGULAR groove for "O" ring illustrating the principle of diametral squeeze.**

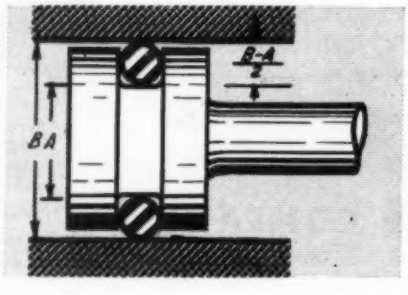
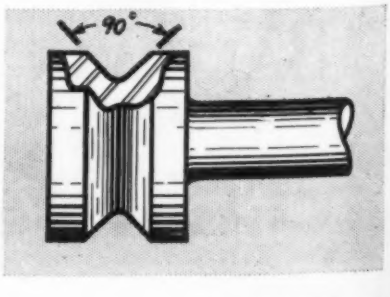



**FIG. 3. V-GROOVE for "O" ring, now discontinued, was used as an expedient in cold weather operational tests.**



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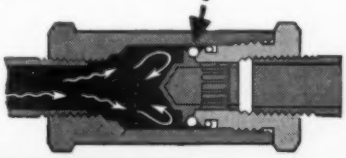

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## Development of "O" Rings

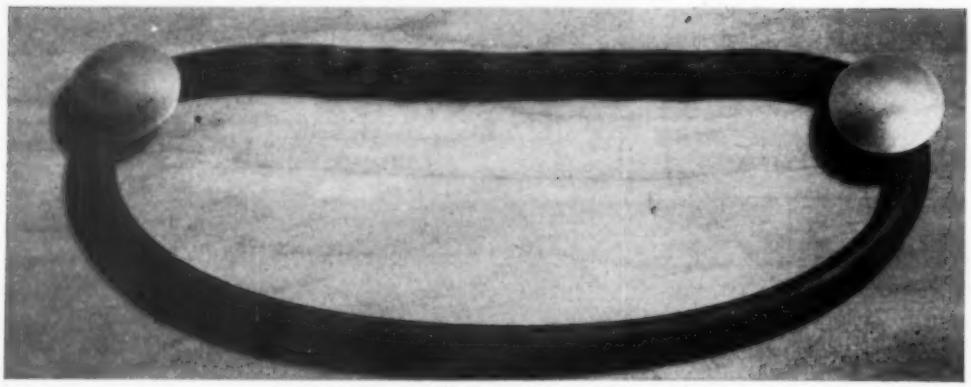

**FIG. 4. SPIRAL FAILURE of "O" rings, long a critical problem in aircraft hydraulic systems, is now yielding to intensified research. In this unretouched photograph thumb tacks are used to point out area (top) of spiral failure.**

successful operation of a hydraulic system is largely dependent upon the satisfactory operation of the "O" rings contained in that system.

The actual compounds for current approved "O" rings are trade secrets. However, the base polymer used in each compound is known. In each case it is Nitril a Buna N type rubber, Paracril 18-80, which is essentially 18 percent acrylonitril and 80 percent butadiene. The low acrylonitril contest allows the maximum of cold resistance at the expense of volume swell in the standard base hydraulic fluid, MIL-O-5506. To achieve the optimum cold resistance, the "O" ring compounds are highly plasticized. Plasticizers are materials that are used in the compound to improve the flexibility of the "O" ring at —65 F. Plasticizers are extractable by various fluids; some plasticizers will evaporate from the compound under air aging conditions. Petroleum base fluids tend to replace the plasticizer as the latter is extracted, often causing a volume swell in the process. Other fluids or greases may extract the plasticizer and may not replace it, resulting in a degree of shrinkage.

In considering the volumetric swell of approved "O" ring compounds in MIL-O-5506 fluid, the aniline point of the fluid is a determining factor. Fluids with a low aniline point will cause a high volumetric swell of an "O" ring compound; conversely, fluids with a high aniline point will cause a low volumetric swell. For this reason, "O" ring compounds are tested in a high swell reference fluid as well as in a low swell reference fluid.

The cross-section of the "O" rings varied from a nominal value of 1/16 to 1/4 inch, depending upon the I.D. of the ring. Drawing AN 6230 was also released to replace the numerous square and rectangular static pressure packings which had been used. AN 6227 "O" rings are used for either static or dynamic applications. All AN 6230 packings have a nominal 1/8 inch cross-section and are to be used in static applications. The small cross-section of the AN 6230 packing allows a reduction in wall thickness of the fabricated parts in which they are to be used. The specification included a cold test at –40 F and specified a Shore durometer of 70 for "O" ring compounds.

A compound of 70 Shore durometer hardness was chosen in order to achieve flexibility at extreme low temperatures and still retain necessary wear resistance properties. For commercial applications, where –65 F operation is not required, an "O" ring with a Shore hardness of 80 to 90 will have a much longer life than the softer 70 ring.

The "O" ring groove length was calculated on the basis of approximately 133 percent of the free cross-section diameter of the "O" ring. This allowed an increase in ring cross-section in the direction of the center line of the cylinder caused by squeeze of the ring. Also, space is provided for the allowable volumetric swell of the compound and allows some rolling of the "O" ring. This has reduced the breakaway or starting friction of the "O" ring over installations where rolling is prevented. Finally, the longer groove permitted easier installation and removal of the "O" ring.

### *Compound Development*

The development of a compound for use in molding the "O" rings was difficult and required extensive study and experimentation. The rubber chemists were faced with a tremendous problem; some laboratories developed as many as 30 or 40 compounds over a period of many months before approaching a suitable compound. Manufacturing techniques for making a high quality production "O" ring for aircraft use was a laborious process. Packing manufacturers were working with synthetic rubber stocks which were relatively new.

Early research in the field of "O" ring development was carried on independently by each company and the military services, with the latter attempting to coordinate the entire program from the standpoint of procurement. During initial tests on "O" ring compounds, it was concluded that even though a compound appeared to be suitable from the standpoint of physical tests, a cycling performance test was necessary to prove the wearing qualities of the "O" ring.

Considerable work has been done on a packing test machine (developed under an old Air Corps Specification 40564). An improved design, shown in Specification AN-HH-P-114, was used as a means of evaluating

Continued on page 114

## Tenth Member Joins Advisory Board

Wilfred F. Talbot, Supervisor, Hydraulics and Pneumatics, Northrop Aircraft, Inc., Hawthorne, California, has accepted appointment to the Editorial Advisory Board of the Aviation Section of APPLIED HYDRAULICS. Fred is an Illinoisan and received his education at Joliet Junior College, U.C.L.A. and Northrop Aeronautical Institute. His early career was spent in the Chicago area with such firms as West-

*Wilfred F. Talbot*

ern Electric, International Harvester and the Pullman Company. He went to Douglas Aircraft in 1939; was with Hughes Aircraft for a short time and in 1941 joined the Hydraulic and Landing Gear Group of Northrop Aircraft. He has worked on nearly all Northrop designed planes and was the Hydraulic Lead Engineer on the Flying Wings. He later worked as Hydraulic Staff Assistant; at present he is Supervisor of Hydraulics and Pneumatics of piloted airplanes and missiles.

Fred likes all types of outdoor sports and is particularly active in golf and bowling. As a hobby he tinkers with television kits. He is a registered M. E. in California.

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### *Prize Paper Contest*

Over fifty papers, many of them excellent, were submitted for the APPLIED HYDRAULICS Prize Paper Contest. All score sheets have now been received from the judges and the winning entries have been determined. Announcement of prize winners, including papers that won Honorable Mention, will be made in the October issue.

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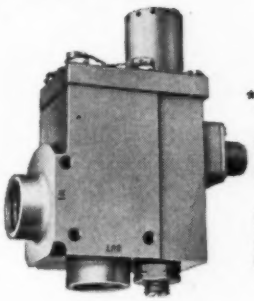
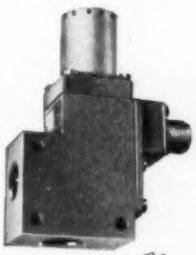
**PRODUCED TO RIGID AIRCRAFT STANDARDS**

26038 WITH INTEGRAL RELIEF.
NORMALLY CLOSED.
¼" and ⅜" LINE SIZES.
Operating pressure: 350 psi;
Relieves inlet to outlet within 500 to 700 psi range.
Weight: 0.60 lb.
(Also available in 1500 and 3000 psi capacities.)

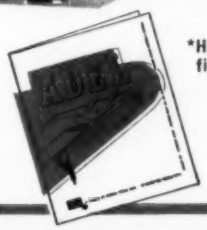


*25853 PILOT OPERATED.
NORMALLY CLOSED.
⅜" and ½" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.45 lb.
(Also available with manual override or normally open.)

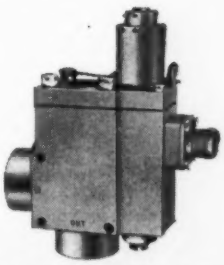


*26610 PILOT OPERATED.
NORMALLY OPEN.
¼" and ⅜" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 0.81 lb.
(Also available normally closed.)

*High Flow Capacity Valve with filtered pilot circuit.



FLUID: Specs. MIL-O-5606 or MIL-F-7083.
ELECTRICAL RANGE: 18-30 VDC.
SOLENOID DUTY: Continuous.
CURRENT DRAIN: 0.5 Amp at 24 VDC.
TEMPERATURE RANGE: —65°F to +250°F.
LIGHTWEIGHT, COMPACT, CORROSION RESISTANT CONSTRUCTION.



*25670 PILOT OPERATED. WITH MANUAL OVERRIDE.
NORMALLY CLOSED.
¾" and ⅝" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.58 lb.
(Also available normally open without manual override.)

Write for new, descriptive Brochure containing detailed information on ADEL's line of Aircraft Equipment and facilities. Address ADEL DIVISION, GENERAL METALS CORPORATION, 10759 Van Owen St., Burbank, Calif.

ADEL produces a complete line of Aircraft HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT, HEATER, ANTI-ICING & FUEL SYSTEM EQUIPMENT, ENGINE ACCESSORIES AND LINE SUPPORTS.

ADEL LEADER IN HYDRAULICS

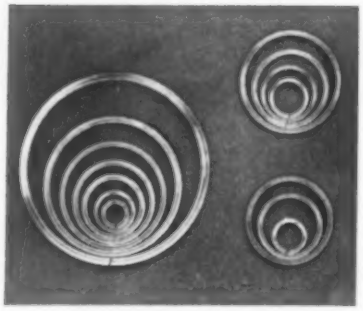
DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA.

CANADIAN REPRESENTATIVE: RAILWAY & POWER ENGINEERING CORPORATION, LIMITED

# NEW PRODUCTS

**Components, tools and equipment designed to improve operation of fluid power systems are described here . . . for more information fill in and mail the post card bound in this issue.**

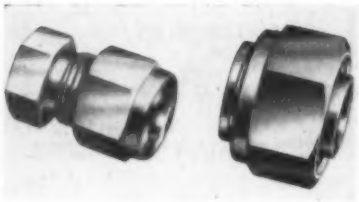
Continued from page 19



### *PISTON ROD SCRAPER RINGS . . . increase component life*

**Designation:** Hydro-Wype AN-6231-A Scraper Rings.
**Features:** Meet MIL-S-5049 requirements which include a scraping edge free of nicks and burrs; made of copper based alloys and have no internal strains or cracks when subjected to the mecurious nitrate and nitric acid tests. Are required to fit a ground piston rod 95 percent light-tight at all times.
**Applications:** In hydraulic, electronic or mechanical cylinders and actuators, where component life can be lengthened by keeping the piston rod free of dirt, dust, ice and other foreign material.

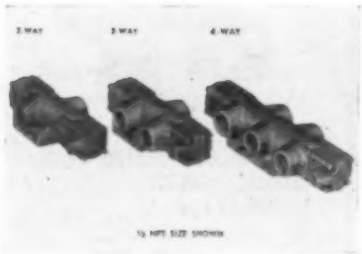
**Gadgets, Inc.**
**Dayton, Ohio**
Circle 140 on Reader Service Card



### *CAP AND PLUG FITTINGS . . . are added to line*

**Designation:** Swagelok Cap and Swagelok Plug.
**Service:** The cap is used for capping end of tube and the plug is for plugging unused port of fitting. Both of these come completely assembled, finger-tight, and require only one and one-quarter turns of a wrench to provide a torque-free, leakproof seal.

**Crawford Fitting Company**
**Cleveland, Ohio**
Circle 141 on Reader Service Card



### *DIRECTIONAL VALVES . . . added in ⅜ and ½ inch sizes*

**Features:** Larger capacity basic valves, ⅜ and ½ NPT sizes have been added as a companion line to the series of ⅛ and ¼ NPT size pneumatic and hydraulic valves. Available in two, three and four-way types, the new sizes utilize the same size actuating devices used in the smaller valves. Hand, cam, pilot or foot actuating devices with or without spring return can be used singly or in dual combination to meet any actuating need.

**Versa Products Company**
**Brooklyn, New York**
Circle 142 on Reader Service Card

### *BRONZE IMPELLER PUMP . . . is positive displacement unit*

**Features:** The positive displacement delivery, the result of two axially oscillating impellers which deliver continuous, non-surging flow without foaming or air entrainment. Precision machined and sintered bronze powder metal impellers, which act like oilless bearings operating in a lubricating medium in that they absorb oils like a sponge and retain them, greatly minimizing the dangers of heat seizures and scorched impellers.
**Applications:** Suitable for operating oil temperatures up to 500 degrees F. For all types of machines, tools, equipment and devices.

**Eco Engineering Company**
**Newark, New Jersey**
Circle 143 on Reader Service Card

### PRESSURE SWITCH
**. . . uses Bourdon tube principle**

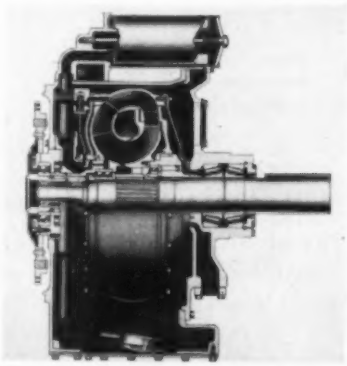
**Designation:** Simple Switch.
**Specifications:** Has a rating of 110V-AC-½HP, and can be used as a control up to any horsepower. The unit measures only 3 inches in diameter by 2 inches, with a shipping weight of 12 ounces.
**Features:** High and low pressure limits can be adjusted independently to any range within 100 lbs., including fractions of an ounce. For pressures over 100 lbs., an interchangeable unit can be installed with a single screw. No lubrication is necessary. Operation cannot be affected by oil or abrasives such as scale, sand or lime.
**Applications:** Suitable for use on water, air or hydraulic pressures.

**Simple Manufacturing Corp.**
**Syracuse, New York**

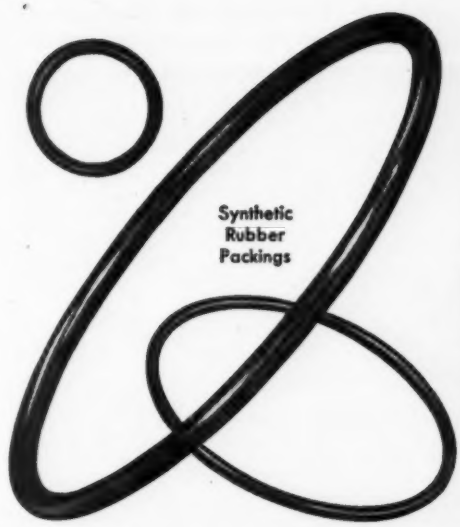
Circle 144 on Reader Service Card

### TORQUE CONVERTER
**. . . for industrial drives**

**Designation:** Model SD.
**Design:** Has a standard spider drive input, and is equipped with a built-in converter charging pump around the input shaft, just adjacent to the drive spider. Inlet and outlet connections are provided for piping the converter fluid to and from a cooler, which can be either an oil-to-



water heat exchanger or an oil-to-air radiator. Quick release dump valves on the rotating turbine wheel, to permit release of the oil from within the converter circuit, providing a complete disconnect feature. A 2-position control valve, located on top of the stationery converter housing, for actuation of the dump valves.
**Features:** Particularly compact


you can TRUST a TROSTEL seal

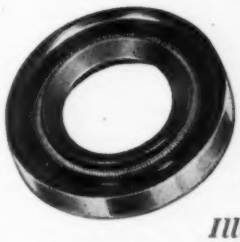
every specification is pilot-tested for *Production Quality*

Because engineered packings and oil seals often require special processing . . . Trostel designs and builds the production tools entirely within its own organization.

As soon as laboratory development is completed, Trostel engineers pilot-test the entire production operation in miniature . . . in order to ascertain the processing and tooling techniques which will retain *in production* all of the special properties and tolerances called for in the customer's specifications.

The result is a packing or oil seal that can be produced to laboratory quality standards . . . in quantities of hundreds, or hundreds of thousands.

A seal you can trust!




*Illustrated Bulletin On Request*

**ALBERT TROSTEL PACKINGS, LTD., Lake Geneva, Wis.**
*Formerly Division of Albert Trostel & Sons Co., Milwaukee, Wis.*

BRANCH OFFICES
NEW YORK
LOS ANGELES
SAN FRANCISCO
SEATTLE · HOUSTON
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TROSTEL QUALITY

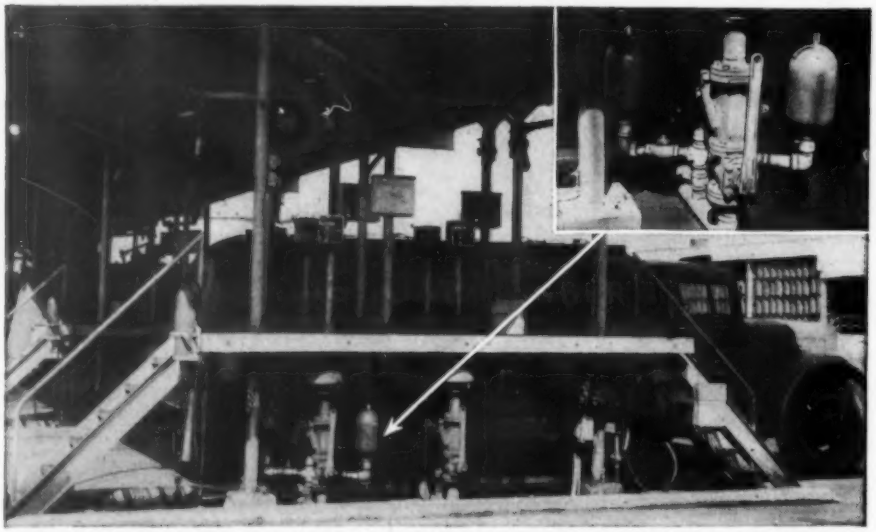
TROSTEL packings




Circle 103 on Reader Service Card

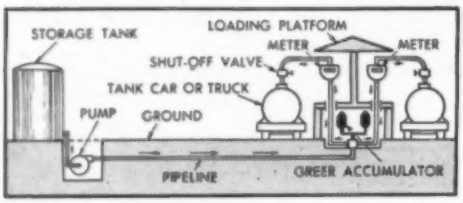
# GREER TOPICS

**Functions and Applications of the Greer Accumulator**

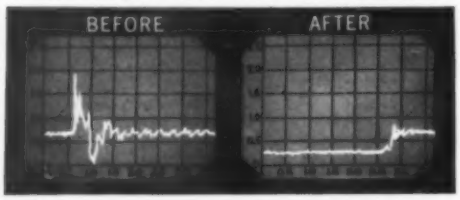


To reduce line shock effectively only two Greer Accumulators were necessary to handle this series of loading racks for petroleum bulk station. Inset: closeup of installation.

# How Greer Accumulators Suppress Line Shock




Above: a schematic of bulk station operation. Below: hydrauliscope gives conclusive evidence that line shock was reduced more than 100% when three valves were closed at once. Write for hydraulic line shock Bulletin 600.




## Pressure surges from rapid opening and closing of valves effectively reduced

In loading tank cars or trucks from petroleum bulk stations as an example (see schematic diagram on left), the amount of fuel pumped into a tank must be carefully measured by flowmeters.

By just opening and closing the shut-off valve, line shocks develop with great intensity to cause repetitive flowmeter failures that result in erroneous readings. This can be costly to the operator selling this fuel at a given price.

By installing Greer accumulators that function as perfect shock absorbers, these dangerous pressure surges are made harmless (see hydrauliscope test on left). The elimination of costly flowmeter and pipeline maintenance more than paid for the accumulators within a year.

If your problem is hydraulic line shock, a Greer accumulator is the answer. Let our engineers help you. Call or write today. No obligation.

## Greer accumulators have many uses as:

(1) Pressure storage chamber for main, auxiliary and emergency power (2) Pressure-volume compensator for leakage and temperature (3) Dispenser of fluids and lubricants (4) Transfer-barrier for fluids and gases (5) Shock absorber for line shock and pump pulsation.

*Precision engineered to make any hydraulic system better! Complete data and diagrams in Brochure 301. Write for your free copy.*

GREER ACCUMULATORS

U.S. PATENTS UNDER OLAER LICENSES

**Greer Hydraulics Inc. 454 Eighteenth Street, Brooklyn 15, New York**

Field Offices: 1908 West Cermak Road, Chicago, Illinois • 25 South Main Street, Dayton, Ohio 2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities


## New Products

in size, the overall length is considerably less than a converter equipped with a conventional friction clutch between the engine and a converter.

**Applications:** To meet the requirements of certain engine applications needing converter drive with specific performance characteristics.

**Twin Disc Clutch Company**
**Hydraulic Division**
**Rockford, Illinois**

Circle 145 on Reader Service Card

### OIL COOLERS
### . . . have compact design

**Design:** Use of longitudinal inner-fins makes possible a more compact unit. Synthetic rubber O-rings provide positive seals and eliminate all packed and soldered joints. The inner-finned element is all copper and is removable for cleaning and replacement.

**Operation:** The oil flows through the inner-fins, which provide generous surface for

cooling with minimum pressure drop. Various models are suitable for oil side pressures up to 250 psi and temperatures up to 300 degrees F. Water side is suitable for pressures up to 150 psi.

**Heat-X-Changer Co.**
**Brewster, New York**

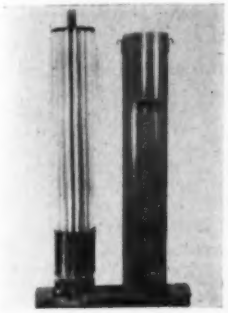
Circle 146 on Reader Service Card

### AIR FILTER
### . . . with disposable cartridge

**Designation:** Model A-100-D Condensifilter.

**Design:** Uses a new type of disposable filter cartridge which provides greater economy of operation. Constructed of wire mesh and flannel cloth, the cartridge provides over twenty-four square feet of filtering area. When the filter becomes dirty, the entire cartridge is quickly replaced by removing only one nut at the top of the filter. Also incorporates a snap-action, spring-loaded trap. Accumulated condensate is discharged

through the trap valve, which is designed to prevent leakage or pressure loss.

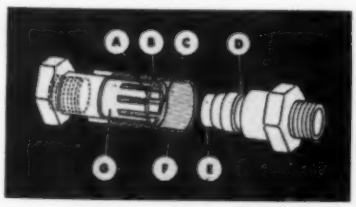


**Features:** Requires no attention during periods of operation. It is completely automatic and will operate five to six months without renewing the filter.

**Hankinson Corporation**
**Pittsburgh, Pennsylvania**
Circle 147 on Reader Service Card

### *QUICK COUPLING*
### *. . . applied to pressure systems*

**Operation:** To couple, the sleeve is moved to the rear the approximate distance F, allowing the fingers of the collet to expand slightly. The male portion is s then inserted. As the sleeve is then moved forward, the shoulder C engages over shoulder D. As this engagement is completed, ribs A seat in slot B, securely locking the coupling. Reverse movement of sleeve provides immediate disconnect.




Where pressures are not involved a simple seal is used where point E seats at point G. Where they are involved seals suitable for pressures indicated are utilized.

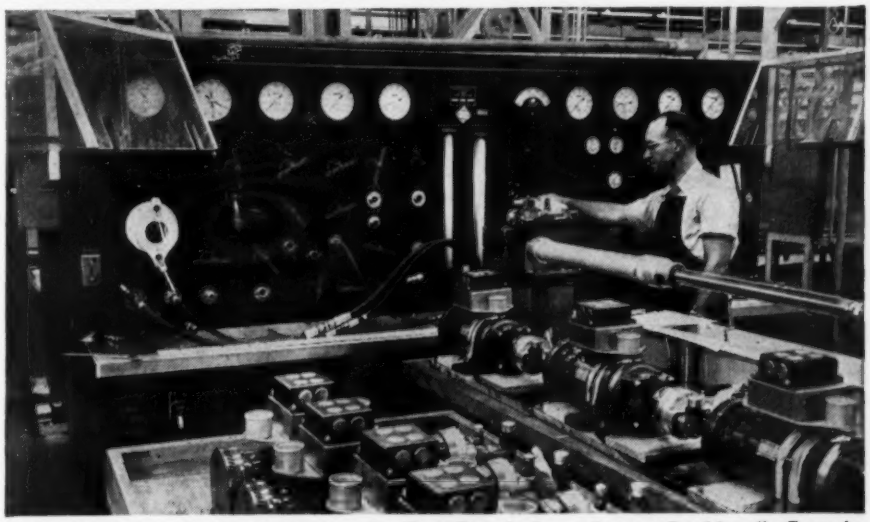
**Features:** Standard checks can be incorporated in the design for shut-off. Standard connections can be adapted to either end.

**Applications:** For flexible cable or tubing, hose and pipe carrying many types of liquids or gases in a wide range of pressures.

**Corley Sales and Engineering Co.**
**Dayton 2, Ohio**
Circle 148 on Reader Service Card

# GREER TOPICS

**Important News of Aviation & Industrial Test Equipment**



Greer Stationary Hydraulic Accessories Test Stand, shown here at Lockheed's Georgia plant, provides a shop-type machine to fully check the performance of hydraulic system accessories including system pump at flow rates to 20gpm, pressures to 3400psi.

## Why Does Lockheed Aircraft Test with Greer Equipment?

### Why does almost any aircraft builder you can name test with Greer?

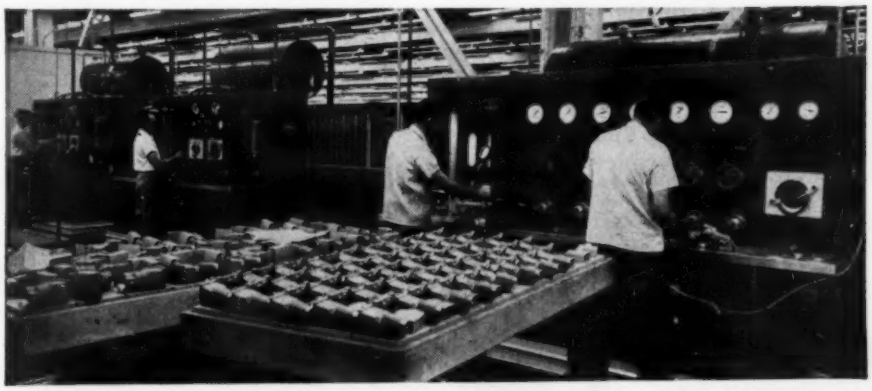
Because the entire industry knows it can *depend* on Greer. It's as simple as that. That's why Lockheed Aircraft Company, famous builders of the Constellations and many military aircraft, choose Greer Test Equipment.

Greer points to an unequalled record for service to the aircraft industry. A reputation that guarantees complete satisfaction. A list of customers that reads like a "Who's Who" of aviation.

Pioneers in test equipment, Greer has more recently aroused industry-wide interest by furthering the standardization of test equipment. A study of the Greer catalog (write on your letterhead for free copy) will reveal a remarkable selection of standard units for a great variety of test jobs.

For out-of-ordinary requirements, call or write Greer's engineering department. Men with experience you could never match are waiting to go to work on your problem.

GREER
TEST EQUIPMENT



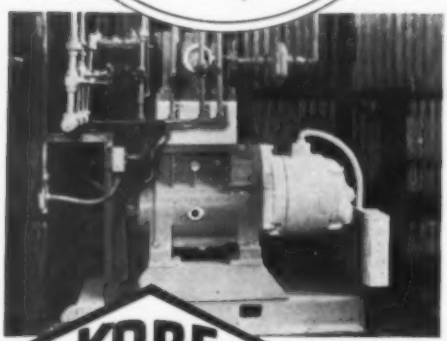
Greer Dual Fuel Booster Pump Test Stands, shown on left, provide test components for checking run-in and performance on two fuel pumps simultaneously with flows up to 60,000pph and pressures to 100psi. Greer Fuel Pump and Accessories Test Stand, on right, checks all fuel components with flows to 300gpm and pressures to 800psi.

**Greer Hydraulics Inc. 454 Eighteenth Street, Brooklyn 15, New York**

Field Offices: 1908 West Cermak Road, Chicago, Illinois • 25 South Main Street, Dayton, Ohio
2832 East Grand Boulevard, Detroit, Michigan • and sales representatives in all principal cities



Circle 42 on Reader Service Card



KOBE Heavy Duty High Pressure

# Triplex Pumps

*Case History A-13:* In 1942 The Buehler Tank and Welding Works, Los Angeles, makers of liquefied petroleum gas tanks and other pressure and non-pressure vessels, installed a Kobe Size 2 Triplex.

*8000 psi Required*

The pump is used to supply pressure to press cold drawn tank heads of various shapes. Due to the small diameter main cylinder, pressure required is 8000 psi—a pressure unobtainable in ordinary commercial pumps.

*"Light Maintenance"*

W. P. Buehler states: "The Kobe unit has been in service for 11 years. It has given us very little trouble and requires only light maintenance. We are well satisfied. In fact, so much so that in 1948, we purchased another Kobe unit—a Size 3 Triplex—to supply continuous pressure for our hydraulic assembling equipment."

*Triplex Features*

- **Pressures**—To 5,000 psi (standard) To 20,000 psi (special)
- **Volumes**—To 60 g.p.m.
- **Power Ratings**—15, 30, 50 H.P.
- **Integral Double Reduction Gears**
- **Integral Electric Drive** (Optional)
- **Easily interchanged Plungers and Liners**

*Write for Bulletin*

KOBE INC., Division of Dresser Equipment Co., 615 NBC Bldg., 815 Superior Ave., N.E. Cleveland 14, Ohio

KOBE INC.
*Division of Dresser Equipment Co.*
Plant: Huntington Park, Calif. — Representatives in CLEVELAND, Pittsburgh, New York, Houston, Oklahoma City.


## New Products

Continued

### TUBE FITTINGS
### . . . for leak-proof systems

**Features:** The principle of expanding tubing into specially designed tube fittings is now well established and enables positive leak-proof joints to be made in shorter time and at lower cost.

Extremes of temperature and vibration have no effect upon this design of tube fitting, while all fluids, gases and corrosive agents can be handled with the selection of the correct materials for both tube and fittings.

**Construction:** Coupling parts can be made in nonstabilized stainless steel; mild steel, cadmium plated; aluminum, anodized; or titanium.

**Applications:** Designed for attachment to rigid tubing by mechanical means with suitable hand tools and without brazing, welding or flaring operations.

**Avica Corporation**
**Portsmouth, Rhode Island**

Circle 149 on Reader Service Card

### NEW HOSE DEVELOPED
### . . . for jet engine applications

**Designation:** Anti-Icing Hose Line.

**Feature:** One of the important features of the anti-icing hose line is the "Little Gem" fitting. The design of this fitting is such that the reinforcing braid of the hose alone is clamped between the socket and the nipple, while the fluid tight seal is accomplished by separating the end of the inner tube from the braid

Reliant "O" Ring
GROOVE GAGES
Dimensional Control of internal "O" ring grooves.
Checks standard ranges ⅛ to 4⅛ accurately and quickly.
Low in cost.
Also use as a dial bore gage - taper - blind holes.
Checks out of round - recesses - spherical radii.
Sold only through industrial distributors.
Reliant Industries
4947 FIRESTONE BOULEVARD
SOUTH GATE, CALIFORNIA

and using it as a lip seal in an annular chamber. The advantage of the little gem lies in the elimination of any compression of the rubber like inner tube.

**Construction:** This hose is constructed of a silicone inner tube and a stainless steel cover that gives the hose strength, prevents tube collapse and provides resistance to abrasion.

**Application:** Conveys hot air at temperatures as high as 450 F. from the last stage of the jet engine compressor forward to the engine nose to prevent ice formation. Maximum operating pressure is 120 psi.

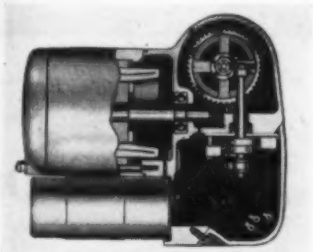
**Aeroquip Corporation**
**Jackson, Michigan**
Circle 150 on Reader Service Card

### *REMOTE CONTROL MOTOR . . . operates variable speed motor*

**Designation:** ERC Remote control motor.

**Rating:** 1/15 hp, 1800 rpm, of the reversible capacitor type.

**Features:** Is compactly attached to the Varidrive, replacing the



control handle and is operated by a push button. It has a low inertia rotor for quick stop. Its rugged worm drive actuates the Varidrive's speed control shaft as well as the adjustable limit switches. The connection box is an integral part of the unit.

**Application:** To provide a positive electrically driven control for Varidrive motors.

**U. S. Electrical Motors, Inc.**
**Los Angeles, California**
Circle 151 on Reader Service Card

### *AIR PRESSURE REGULATOR . . . has wide operating range*

**Designation:** Model 20AA00-6.

**Features:** Continuous and precise control of air pressure from 2 psi to 120 psi. Greater air capacity, capable of delivering

With Sylphon nylon "V" seals, you can improve sealing operations—eliminate leakage—gain more money-saving advantages. See what this combination of nylon, "V" type construction, and outstanding Sylphon quality and precision workmanship gives you:

**Less shaft friction**
**Excellent resistance to many chemicals, aromatic fuels, hydraulic oils, etc.**
**Simple installation**
**Low cost**

**Application in multiple for high pressures**
**Wide temperature range (-100° F. to 250° F.)**
**No deterioration in stock**

*Many uses:* especially suited for sealing external or internal cylindrical surfaces in many applications—aircraft, automotive, oil refineries, hydraulics, Diesel and other engines, and in the chemical and other industries. Write for information. Ask for Bulletin PU-827.

Robertshaw-Fulton CONTROLS COMPANY
FULTON SYLPHON DIVISION
Temperature Controls · Bellows Devices · Bellows Assemblies
KNOXVILLE 1, TENN.

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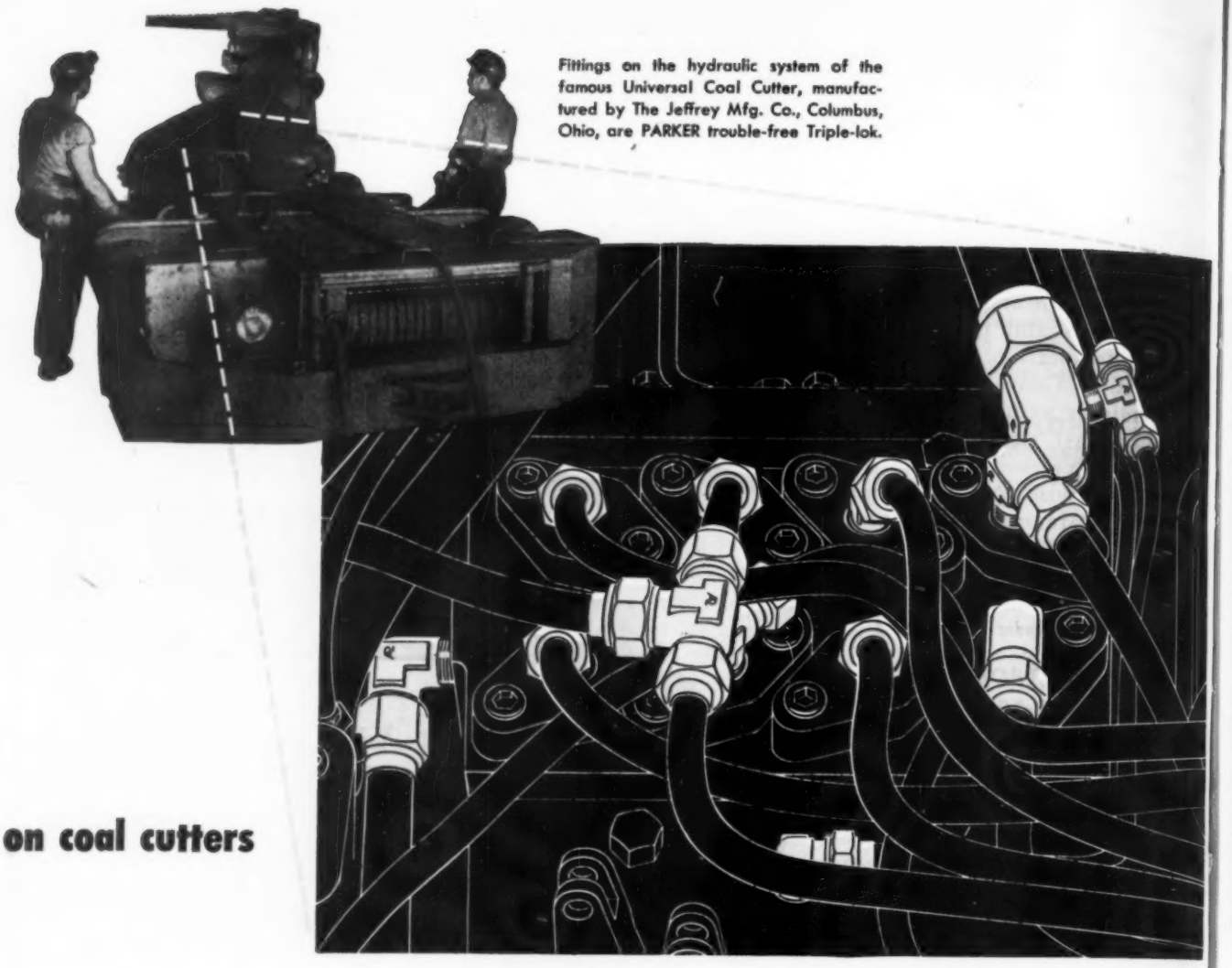

Fittings on the hydraulic system of the famous Universal Coal Cutter, manufactured by The Jeffrey Mfg. Co., Columbus, Ohio, are PARKER trouble-free Triple-lok.

**on coal cutters**

# Tube it up...Forget it...WITH PARKER

## TROUBLE-FREE TRIPLE-LOK FITTINGS

Few machines get rougher use than coal cutters in coal mines. Subjected to severe vibration, caused by the action of the cutting head, and operating under the most adverse conditions, all parts must be ruggedly built, including the hydraulic system.

You'll find Parker Triple-lok Fittings on coal cutters and many other machines used in rough, rugged service because they are leakproof under the severest conditions of vibration, elevated temperatures, high pressures and repeated assembly. Parker Fittings meet the specifications of the A.S.M.E. Code for Pressure Piping, as well as J.I.C. and S.A.E. standards.

So *tube it up* and *forget it* . . . with Parker Triple-lok Fittings. Ask your Parker Distributor for Tube Fitting Catalog 4300, or write The PARKER Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

**This does it**

**Triple-lok . . . 3-piece flare fitting famous for its sleeve . . . the easiest way to install tubing systems. Made in brass, steel, stainless steel, aluminum alloy.**

Precision Mark of

Leakproof Tube Fittings

**Parker**

TUBE FITTINGS • VALVES • O-RINGS

Plants in Cleveland • Los Angeles • Eaton, Ohio • Berea, Ky.

# Parker

**INDUSTRIAL TUBE FITTING STOCKS CARRIED BY**

AKRON 9, O.—B. W. Rogers Co., 850 So. High St.
ARDMORE, Pa.—Louis H. Hein Co., 15 West Lancaster Ave.
BALTIMORE 13, Md.—Carey Machinery & Supply Co. 3501 Brehms Lane
BALTIMORE 5, Md.—Whitehead Metal Products Co. 4300 E. Monument St.
BEAUMONT, Tex.—Standard Brass & Mfg. Co., 705 Milam St.
BOSTON 15, Mass.—A. E. Borden Co., 176 Brookline Ave.
BRYSON CITY, N. C.—Wallace Co. of Carolina, P.O. Box 572
BUFFALO 7, N. Y.—Whitehead Metal Products Co. 2128 Elmwood Ave.
CAMBRIDGE 39, Mass.—Whitehead Metal Products Co. 281 Albany St.
CEDAR RAPIDS, Ia.—Globe Machinery & Supply Co. 309 8th Ave., S. E.
CHICAGO 14, Ill.—Wallace Tube Co., 1300 Diversey Pkwy.
CINCINNATI 29, O.—Williams & Co., 3231 Fredonia Ave.
CLEVELAND 14, O.—W. M. Pattison Supply Co. 777 Rockwell Ave.
CLEVELAND 15, O.—B. W. Rogers Co., 1900 Euclid Ave.
CLEVELAND 14, O.—Williams & Co., 3700 Perkins Ave.
COLUMBUS 8, O.—Williams & Co., 851 Williams Ave.
DALLAS 9, Tex.—Metal Goods Corp., 6211 Cedar Springs Rd.
DAVENPORT, Ia.—Globe Machinery & Supply Co. 410 East Second St.
DAYTON 10, O.—J. N. Fauver Co., 1534 Keystone Ave.
DENVER 2, Colo.—Metal Goods Corp., 2425 Walnut St.
DES MOINES 6, Ia.—Globe Machinery & Supply Co. East First & Court Ave.
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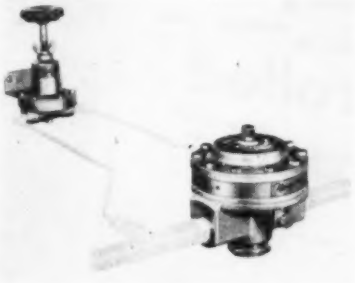
HARRISON, N. J.—Whitehead Metal Products Co. 1000 South Fourth Ave.
HOUSTON 3, Tex.—Metal Goods Corp., 711 Milby St.
HOUSTON 1, Tex.—Standard Brass & Mfg. Co. 2018 Franklin St.
INDIANAPOLIS 27, Ind.—Korhumel Steel & Aluminum Co. 3562 Shelby St.
JACKSONVILLE, Fla.—Florida Metals Inc. 2937 Strickland St.
KANSAS CITY 16, Mo.—Metal Goods Corp., 1300 Burlington Ave., North Kansas City
KNOXVILLE 5, Tenn.—Leinart Engineering Co. 412 E. 5th Ave.
LOS ANGELES 4, Cal.—Haskel Engineering & Supply Co. 721 W. Broadway, Glendale
LOS ANGELES 12, Cal.—Metropolitan Supply Co. 353 East 2nd St.
MEMPHIS, Tenn.—J. E. Dilworth Co., 730 South Third St.
MILWAUKEE 3, Wis.—Morman Belting & Supply Co. 522 W. State St.
MILWAUKEE 4, Wis.—Wallace Cos. of Wisconsin 838 So. 6th St.
MINNEAPOLIS 15, Minn.—Vincent Brass & Copper Co. 124 Twelfth Ave., So.
NEW ORLEANS 12, La.—Metal Goods Corp., 432 Julia St.
NEWPORT NEWS, Va.—Noland Co., 27th St. & Virginia Ave.
NEW YORK 12, N. Y.—Nielsen Hydraulic Equipment, Inc. 298 Lafayette St.
NEW YORK 14, N. Y.—Whitehead Metal Products Co. 303 West 10th St.
PHILADELPHIA 40, Pa.—Whitehead Metal Products Co. 1955 Hunting Park Ave.
PITTSBURGH 33, Pa.—Williams & Co., 901 Pennsylvania Ave.
PORTLAND 10, Ore.—Hydraulic Power Equipment Co. 2316 N. W. Savier St.
ROANOKE 10, Va.—Noland Company, 11 Salem Ave.
ROCKFORD, Ill.—Rockford Tool & Transmission Co. 802 Broadway
SAN FRANCISCO 3, Cal.—General Machinery & Sup. Co. 1346 Folsom St.
SEATTLE 9, Wash.—Palmer Supply Co., 222 Westlake, N.
SHREVEPORT, La.—Standard Brass & Mfg. Co. 1557 Texas Ave.
ST. LOUIS 15, Mo.—Metal Goods Corp., 5239 Brown Ave.
SYRACUSE 4, N. Y.—Whitehead Metal Products Co. 207 W. Taylor St.
TOLEDO 2, O.—Williams & Co., 650 E. Woodruff Ave.
TULSA, Okla.—Ardun Supply Co., 317 S. Detroit
TULSA 3, Okla.—Metal Goods Corp., 302 North Boston
CANADA—Railway & Power Engineering Corp. Ltd.
EXPORT—Mercator Corp., 438 Walnut St., Reading, Pa.


## New Products

Continued

more than 200 cfm. Balanced valve construction provides more accurate pressure control.



Remote control—the regulator can be located at any desired point in air line system regardless of accessibility, with the pilot regulator installed at a convenient location.

**Operation:** This pilot controlled regulator utilizes regulated air pressure, minimizing the effect of fluctuating line pressure as a factor in delivering uniform working air pressure. A light adjusting spring in the pilot control regulator makes regulation easy and precise and eliminates the heavy adjusting springs of other type regulators.

**Sizes:** Available in ½, ¾ and 1 inches.

**C. A. Norgren Co.**
**Englewood, Colorado**
Circle 152 on Reader Service Card

### HYDRAULIC WEIGHING UNIT . . . accurate to .1 percent

**Feature:** The new portable weighing systems permit laboratory-accurate force measurement anywhere in the plant and on the job. Each unit contains a load indicator mounted directly on a hydraulic force-measureing cell. Simplified construction makes it rugged enough to stand up under the roughest in-the-field handling. Specially designed handles make the unit


**GET THIS BULLETIN**

**WHETHER IT'S ORIGINAL EQUIPMENT DESIGN OR CHANGING OVER TO AIR, YOU MAY SAVE ENORMOUSLY BY STANDARDIZING ON . . .**

# VALVAIRS

**Thanks to Diversatility**

★ ★ ★

***ESPECIALLY ADAPTED TO TOOLING AND FIXTURE DESIGN***

★ ★ ★

**Eight pages, well illustrated, outlining Valvair's unique advantages *for you.***

**The bulletin starts thus:**

**"Valvair air control valves are the expression of an original, exclusive, perhaps ingenious idea in design and construction.**

**"The objective: To meet virtually countless requirements with fewer types of valves than ever before," etc.**

***Your letterhead request will be answered promptly.***

*3-way, knob-operated air control valve.*

• Valvair Diversatility is an exclusive, original form of standardization. Five basic bodies permit incorporating any one (or two) control assemblies with a standard valve body. Unique Valvair advantages enable us to speed your order at no extra cost. . . Sizes: ¼" through 1". May we fill your orders *now?*

***Get new Bulletin A-8***

**VALVAIR CORPORATION**
*Affiliate: Sinclair-Collins Valve Co.*
**951 BEARDSLEY AVE., AKRON 11, O.**

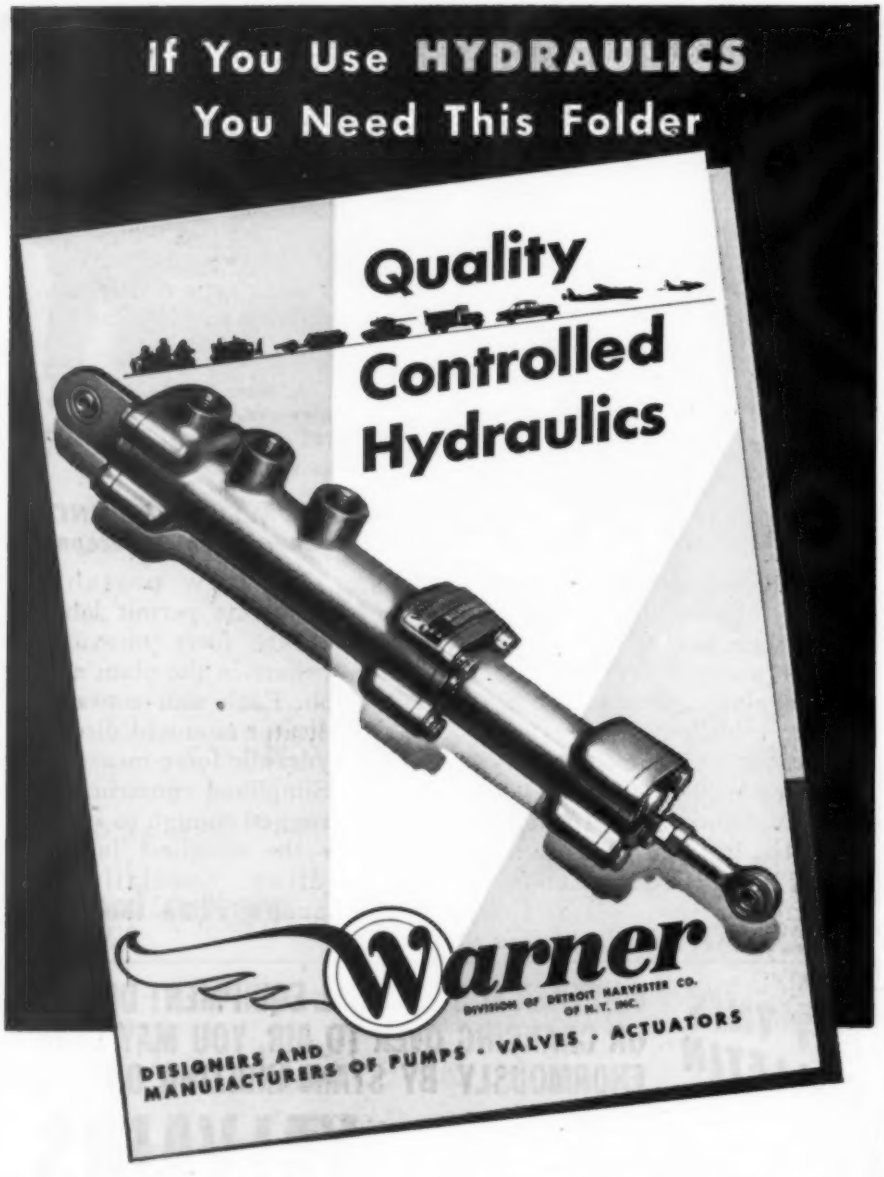
REPRESENTATIVES IN PRINCIPAL CITIES

*Rely Upon* **Valvair**




Circle 110 on Reader Service Card

If You Use **HYDRAULICS**
You Need This Folder




Warner's Extension Power Brake Valve, shown above, has an exclusive hydraulic feed-back feature to give the pilot immediate warning in event of hydraulic system failure. This compact, lightweight, space-saving valve is adaptable to a wide range of system and brake pressures.

Warner is qualified by experience and facilities for the design and production of critical hydraulic equipment for a wide range of uses. Warner engineers will welcome an opportunity to assist you in the development of special hydraulic equipment to meet your particular requirements.

Write for your copy of the illustrated folder shown above describing typical examples of Warner precision hydraulic equipment.

**Warner** DIVISION OF DETROIT HARVESTER CO. OF N.Y. INC.
21535 GROESBECK HIGHWAY • P.O. BOX 3886 • DETROIT 5, MICHIGAN
DESIGNERS AND MANUFACTURERS OF PUMPS • VALVES • ACTUATORS

Circle 112 on Reader Service Card


## New Products

portable. Accuracy in use is guaranteed to be within 0.25 percent of full scale.

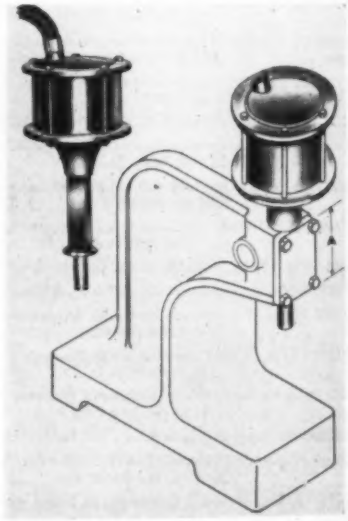
**Sizes:** Available in 24 ranges from 0-500 lb. to 0-100,000 lb. There are four load cell sizes with a choice of 8½, 12 and 16 inch indicators.

**The A. H. Emery Co.**
**New Canaan, Connecticut**

Circle 153 on Reader Service Card

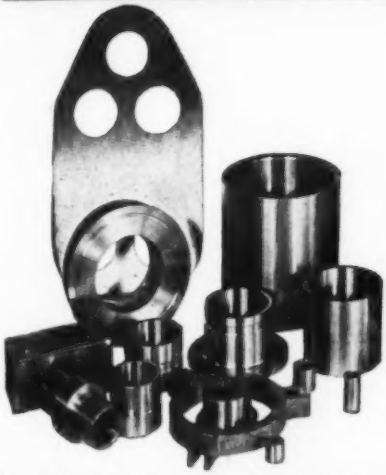
### *AIR CYLINDERS*
***. . . for press conversion***

**Feature:** Ease of interchangeability permits the advantages



and flexibility of having both an air press and a hand press. All tools and fixtures which were made to fit on the bed of the hand press can be used with the air unit without any changes necessary.

**Application:** Convert any hand operated arbor press to an air press. Done by removing pres-



American Crucible methods, experience, know-how and equipment result in highest quality . . . . . bearings that carry a
MONEY-BACK GUARANTEE OF LONGER SERVICE AND LOWER MAINTENANCE COST

PROMET
THE Engineered BRONZE

BEARINGS • BUSHINGS
WEARING PARTS

Machined or Rough Cast of the Specific Formula Best Suited to the Application. Write for literature or send blueprints, conditions of operation, etc. for quotations and recommendations as to alloys.

THE AMERICAN CRUCIBLE PRODUCTS CO.
1303 Oberlin Ave., Lorain, Ohio, U. S. A.

Circle 6 on Reader Service Card


ent ram and replacing with the air conversion unit.

**Size:** The units can be had with cylinders having a power factor of either 12.5 or 19.6 times that of the air line pressure.

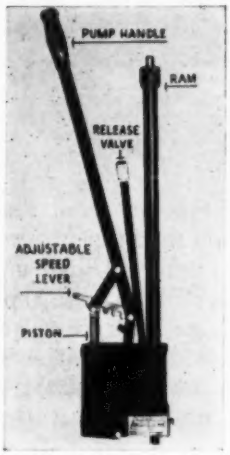
**Price Machine Products**
**Los Angeles, California**

Circle 154 on Reader Service Card

### *HYDRAULIC SYSTEM . . . multiplies lifting speeds*

**Designation:** Varilift.

**Feature:** A 4-speed adjustment




changes the lifting rate from 1-¼ inches per stroke of the hand lever for heavy loads up to 5 inches per stroke for no load. Unloading operations which formerly required 44 hand lever strokes to raise an empty pallet 54 inches, require only 11 strokes with this new system. Two other speed positions adjust the hydraulic capacity to intermediate load weight requirements.

**Applications:** For use on industrial hand trucks.

**Allied Mfg. & Sales Company**
**Chicago, Illinois**

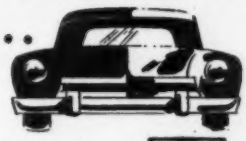
Circle 155 on Reader Service Card

### *3000 PSI HYDRAULIC MOTORS . . . designed for aircraft*

**Design:** Available in 32 standard sizes capable of handling up to 57.8 hp. A variety of porting arrangements and mounting flanges are provided. Overall efficiency of the motors is better than 92 percent at rated speed and pressure. Operation can be continuous, intermittent, continuously reversing or stalled without damage to the motors when


Would you rather drive

this...



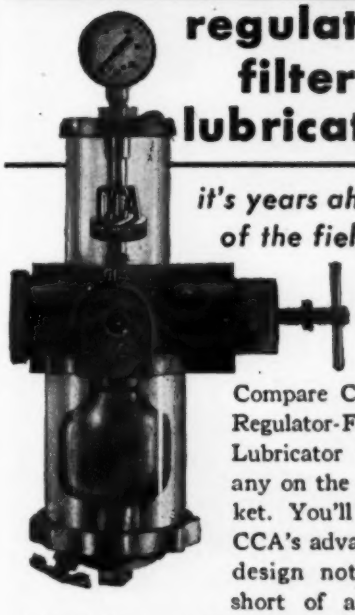
or this...

FOR YOUR PLANT
INSIST UPON THE

CCA

FOR COMPRESSED AIR
regulator
filter
lubricator

*it's years ahead of the field!*



Compare CCA's Regulator-Filter-Lubricator with any on the market. You'll find CCA's advanced design nothing short of astonishing! It's more compact—all in one unit—saves space. Installation involves just 2 pipe connections. (Remember—added connections mean added chance of leaks, added expense). It supplies metered lubrication automatically. Filter removes liquid water by centrifugal action. Unit provides piston type regulation —down to ¼ lb. WITH PRESSURE RELIEF FEATURE BUILT IN. CCA is your best buy . . . by far. Stocked in principal cities. Catalog on request.

CCA PRODUCTS DIVISION
BRECO MANUFACTURING CO.
309 E. SARATOGA ST. • BALTIMORE 2, MD.
*Complete line of compressed air line equipment-including Filters, Lubricators, Regulators, DeHumidifiers*

Circle 16 on Reader Service Card

acro

by AIR CONVERSION RESEARCH

*a high quality low maintenance cost pressure regulator*

it's light!
it's strong!
it's made of A.C.R.'s new miracle alloy . . .
VOLIDIUM!

*Available in both Non-Bleeding and Self-Bleeding models*

**acro** regulators lead the field in capacity and accurate regulation. **acro** prevents secondary pressure losses yet allows instant response to demand changes, and regulates accurately over the entire pressure range. **acro**'s give complete flexibility to solve your air control problems. WRITE, WIRE OR PHONE NOW FOR MORE INFORMATION.

*there is an* **acro** *regulator for every purpose, every pressure!*

AIR CONVERSION RESEARCH
CORPORATION
4107 N. Damen Ave. Chicago 18, Ill.

Gentlemen: Please send me full information about **acro** regulators. Dept. AH
name_____
firm_____
address_____
city_____ state_____



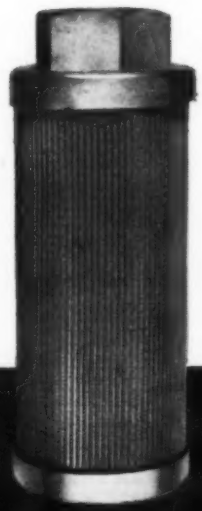

protection is provided by a proper system relief valve. The time required to accelerate the hydraulic motors from stand-still to maximum intermittent speed with no external load using the torque available at 4500 psi (limited usage) varies between 0.0019 seconds for the smallest size motor and 0.0051 for the largest motor. With zero load, the minimum number of revolutions to stop from maximum intermittent speed is between 0.116 and 0.167 for all motor sizes. Illustrated model MF39-06-30, transmits approximately 4.3 hp at recommended speed and pressure.

**Vickers Incorporated**
**Detroit, Michigan**
Circle 156 on Reader Service Card

### *SHUTTLE VALVES . . . for switchover circuits*

**Designation:** 400 series.
**Features:** Designed to provide automatic switchover from either of two control stations, allowing for control from each. Sensitive shuttling action with dead-tight sealing at pressure differentials of from less than ⅓ psi to 3000 psi. Sealing efficiency is achieved by the Circle Seal principle which makes use of a free floating O-ring as a sealing


★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



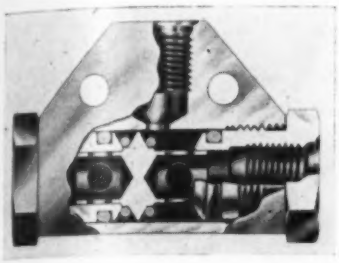
*The New*
CAPITAL HYDRAULIC OIL FILTER
WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery
EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST
SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

member between conical metal seats. Shuttling pressure differential is but a few inches of water.

**Specifications:** Offered for liquid flow rates up to 5 gpm and for



gas flows to 20 cfm. Valves in this series are normally furnished in aluminum with ¼, 5/16, ⅜ or ½ inch tube connections, or in brass with ⅛ or ¼ female pipe connections.

**Applications:** For any type service from 0 to 3000 psi ranging from very low pressure instrumentation circuits to high pressure pneumatic or hydraulic circuits.

**James-Pond-Clark**
**Pasadena, California**
Circle 157 on Reader Service Card

### *LIMIT SWITCH . . . is explosion-proof*

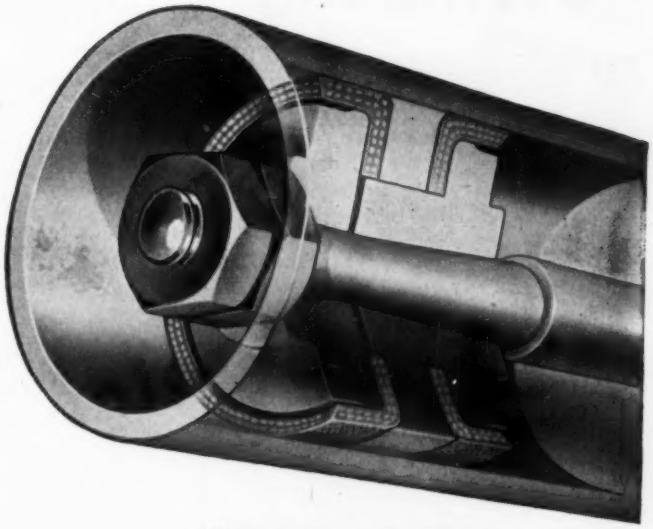
**Designation:** IMLI-EI.

**Design:** Is made so that the user may adjust the operating head to any of four horizontal positions. The roller arm assembly

may be reversed to position the actuator roller on either side of the actuator arm. The roller arm is field adjustable to operate clockwise, counter-clockwise, or in both directions. The actuator arm assembly is adjustable through 360 degrees to any of 870 positive lock positions at intervals of 0.4 degrees. Die cast aluminum enclosures has ⅛ inch thick porous bronze plate fitted

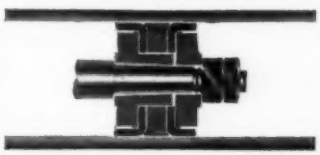

# DARCOVA PUMCUPS

## more efficient...job after job!

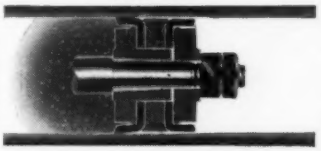


Phantom cutaway showing a typical Pumcup piston assembly.

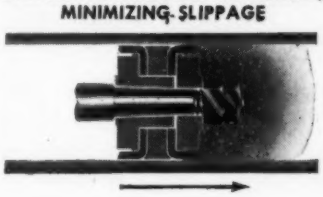
**DIAGRAM OF DARCOVA PUMCUP ACTION (greatly exaggerated)**



NORMAL: BOTH PUMCUPS RELAXED



UNDER PRESSURE: PUMCUPS SEAL AGAINST CYLINDER DESPITE WEAR, MINIMIZING SLIPPAGE



NO matter how tough your pumping problem Darcova Pumcups can help solve it . . . this has been proved in thousands of plants year after year.

**Darcova Pumcup Advantages**

**1.** Texture engineering that not only increases volumetric efficiency, but keeps it high with no appreciable fluid slippage for the entire life of the Pumcups.

**2.** Darcova Composition Pumcups give many times the life of other types of piston packing . . . *at least 3 to 1!*

**3.** Standard or special compositions are available for exceptional stability in handling almost *any* fluid . . . strong acids, alkalies, food products and even troublesome petroleum derivatives.

**Send For Free Bulletin**—Ask for Bulletin No. 4401 on Pumcups for reciprocating pumps; Bulletin No. 4502 on Pumcups for air and hydraulic mechanisms. Address . . .

**DARLING VALVE & MANUFACTURING CO.**
**Williamsport 15, Pa.**

DARCOVA® THE ORIGINAL COMPOSITION CUP
**PUMCUPS**




Circle 26 on Reader Service Card

# O-M air hydraulic CYLINDERS

*are*

**EASIER to install, and service on any application!**

***Free from projecting tie rods and end caps,*** O-M Cylinders slip easily into deep recesses in machine bases. Of All-Steel construction (no castings), they can be turned down to fit in close quarters. They are easily disassembled without wrenches due to internal-locking key. No gaskets to replace when reassembled. And O-M Cylinders *"Fit Where Others Won't"!* They have the lowest coefficient of friction of any cylinder. All end plugs are tapped for universal mounting. The complete range of mounting brackets are interchangeable bore for bore.

***Available in a complete range of sizes*** (1½" to 8" bores), with standard, 2 to 1 and oversize drive rods. Completely interchangeable parts.

**14-day delivery on most sizes**

***Send today for FREE catalog*** and complete set of ½ and ¼-scale templates showing all cylinders and mounting brackets.

**MAIL COUPON NOW!**

**ORTMAN MILLER MACHINE CO.**

**1204 150th Street • Hammond, Indiana**

☐ **Please send latest O-M catalog.**

☐ **Please send complete set of templates.**

**Name**.....

**Company**.....

**Address**.....

**City**.....**Zone**...**State**....


## New Products

over the enclosure opening to vent the basic switch cavity. This porous plate prevents any great pressure build-up in the switch cavity due to the ignition of any explosive atmosphere present.

**Applications:** For use on all types of machinery and industrial equipment in explosive gas or vapor-air atmosphere.

**Minneapolis-Honeywell Regulator Co.**
**Micro Division**
**Freeport, Illinois**

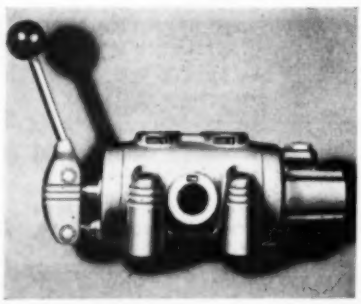
Circle 158 on Reader Service Card

### *HYDRAULIC VALVE . . . has ball detents*

**Designation:** Series 5130, 5160, 5170.

**Design:** 4-way hydraulic valves feature a floating piston design. In this construction, the valve piston fits extremely close in the valve bore. The valve stem is supported in its bearings in the valve covers without any influence on the piston fit in the valve body.

**Features:** The valve is available with one, two or three ball detents: with one detent the valve



piston is held in center position; with two detents the valve piston is held in either end position; with three detents the valve piston is held in both end and center positions. The locking action of the new detent permits the valve to be mounted vertically as well as horizontally and prevents vibration from causing movement of the valve piston.

**Specifications:** Designed for 1500 psi pressure. Offered in three different types of operation: threaded stem, lever and knob. Available in seven sizes: ¼, ⅜, ½, ¾, 1, 1 ¼ and 1 ½


MEASURE, RECORD
*dynamic or transient*
**Pressure Phenomena**

Electro ELECTRONIC EQUIPMENT

## Pressure-Graph

Measures and records pressures in air, viscous liquids, gases and water. Drift and temperature stabilized. Linear outline viewed directly on the oscillograph. 200,000 separate pressure measurements per second; from .5 to over 5,000 PSI. Frequency response 1 to 20,000 cps. Up to 200' of pick-up cable can be used.
Atomic power development.
Hydraulic valve lifts.
Compressor performance studies.
Hydraulic servomechanisms.
Cylinder pressure studies.
Turbine development.

INDICATES
**Rate of Motion at ALL Speeds**
*. . . without physical contact or "loading"*

Electro ELECTRONIC EQUIPMENT

## New Impulse Generator

Small electromagnetic pick-up generates electrical impulses. Self-energized by built-in magnet, it produces a voltage output proportional to the object's rate of speed. Can be actuated by any magnetic material on a moving part. Low price permits use in production machinery.
Indicates RPM, operations; angular or linear motion.
Used in ballistic research.
Used for precision ignition timing.
Acceleration and velocity studies.
Synchronizes voltages for oscillograph; markers for angular or linear position.
Serves as tachometer when used with voltmeter.

**Write for Bulletins • Nearest Sales Engineer**

**ELECTRO PRODUCTS LABORATORIES**
4501--Hp Ravenswood Ave., Chicago 40
Canada: Atlas Radio Corp., Ltd., Toronto

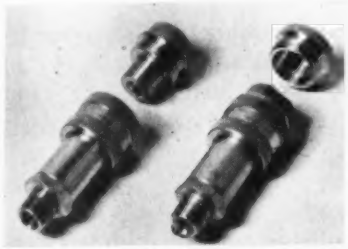
inches; and five piston designs to meet the requirements of any hydraulic circuit.

**Rivett Lathe & Grinder, Inc.**
**Boston, Massachusetts**

Circle 159 on Reader Service Card

### HYDRAULIC QUICK COUPLER . . . for high pressure applications

**Designation:** #3000 Pioneer Hi-Pressure Coupler.
**Sizes:** ⅜ inch Dry Seal PT male x ⅜ inch Dry Seal PT female



and ½ inch-27 tapered thread, male both ends to fit Alemite hose fittings.
**Features:** Self sealing. Maximum free flow up to six times more fluid than other couplings of same size. Newly developed O-ring groove; perfectly centered steel ball checks; the coupler will swivel and uncouple without loss of fluid at low pressures; and is guaranteed to withstand burst pressures of 30,000 psi coupled and each end up to 15,000 psi uncoupled.
**Application:** Extreme high pressure hydraulic applications, wherever a hydraulic line must be connected or disconnected.

**Pioneer Hydraulics, Inc.**
**Minneapolis 1, Minn.**

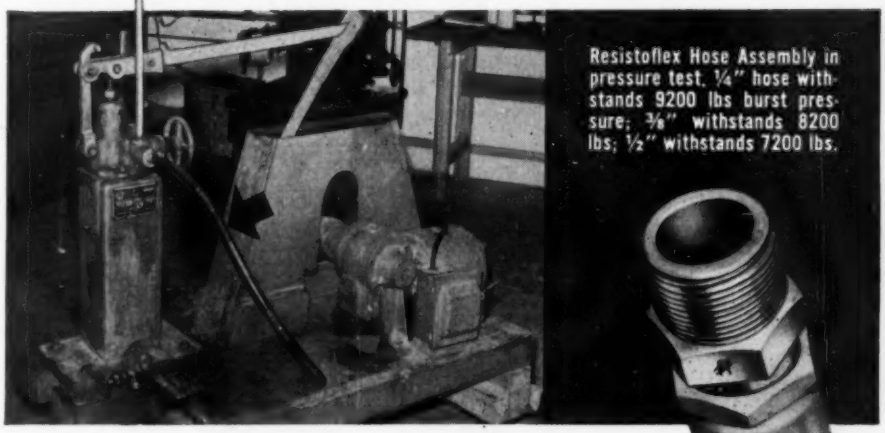
Circle 160 on Reader Service Card

### AIR COMPRESSOR . . . for aircraft pressurization

**Designation:** Series RG-9065
**Design:** It is an integrally assembled motor and built-in pump. Pump-and-motor rotor shaft runs on three ball bearings, pre-lubricated for 1000 hour normal service life. Sliding blades are self-lubricating Graphitar. No seals or shaft packing required in closely fitted pump for standard suction of 2 in. Hg abs. Blades and rotor are only mov-


# never before . . . 9200 psi burst pressure

*with an all-synthetic hose*



Resistoflex Hose Assembly in pressure test. ¼" hose withstands 9200 lbs burst pressure; ⅜" withstands 8200 lbs; ½" withstands 7200 lbs.

***Superior flexing strength, too . . . in***
**RESISTOFLEX INDUSTRIAL HYDRAULIC HOSE ASSEMBLIES**

Such hose strength stems from a combination of special compar tube and modern synthetic yarns. Oilproof and non-aging, compar retains its initial high strength. Fortified with high tensile synthetic fibre braid, it needs no wire for medium-high pressure service.

This construction also provides five other outstanding features for *more hose value per dollar.*

1. *High Pull Strength*—as much as 3500 lbs for ½" hose—and couplings won't pull out even at this tension.
2. *Long Impulse Life*—virtually unlimited fatigue resistance to shock loads and impulse. Hose lasts longer.
3. *High Impact Strength*—hose returns to original cross section after crushing load.
4. *Full Flow at Fittings*—Less than 5% reduction in cross section at crimp.
5. *No Gumming or Clogging*—compar hose lines inert to all hydraulic oils.

*For more information, write for Data Sheet MH-1.*

**TEFLON® SPIRAL BACK-UP RINGS**
Made from uniform "Fluoroflex*-T" tubing—stress relieved before machining for dimensional stability of rings. These anti-extrusion rings withstand elevated temperatures. Self lubricating, they eliminate abrasion on "O" rings, reduce friction of the assembly. Chemically inert and non-fraying, they cause no malfunctioning of other hydraulic system components. Write for data sheet FR-1. **Resistoflex trademark*

**RESISTOFLEX CORPORATION**
**Belleville 9, New Jersey**

SPECIALLY ENGINEERED FLEXIBLE RESISTANT PRODUCTS FOR INDUSTRY




Circle 86 on Reader Service Card

Now Ready for Designers...

New TUTHILL CATALOG

Shows How to Fit General Purpose Pumps to Your Needs

Here is a "must" for product designers —a new handy reference catalog that gives complete data on Tuthill general purpose pumps and how they are adapted to meet your specific requirements. This helpful book includes information on the following types of pumps:

MODEL C

A non-directional general purpose pump with adjustable packing.

MODEL CG

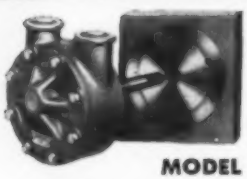
A variation of Model C with spring-loaded packing.

MODEL CB

A mechanically-sealed general purpose pump.

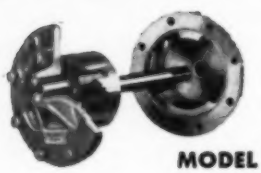
MODEL RC

An automatic reversing pump for general use.



MODEL CS

A stripped pump designed for flange mounting.



MODEL CSA

A stripped pump for built-in applications.

You'll save time, trouble and money with this information at hand. Write today for your copy of Catalog No. 102.

TUTHILL PUMP COMPANY

*Dependable Rotary Pumps since 1927*

939 East 95th Street, Chicago 19, Illinois

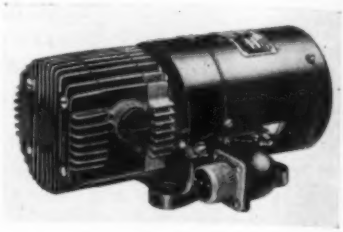
TUTHILL PUMPS FOR THE PURPOSE

*Canadian Affiliate:*

Ingersoll Machine & Tool Company, Ltd. · Ingersoll, Ontario, Canada


## New Products

ing parts, no gumming or sticking, positive starting and pumping at –67 degrees F. A check valve is built into the outlet port of the pump which permits intermittent operation without loss of system pressure when



the air compressor is stopped.

**Specifications:** Motor is ¼ hp, 27 V, dc, 12.5 amperes, 4300 rpm, fan cooled, continuous duty, equipped with built-in radio noise filter. Weight is 8.8 pounds.

**Application:** For supplying oil-free air to electronic installations in aircraft, particularly at altitude to prevent arcing of high frequency current.

**Lear, Inc., Romec Division**
**Elyria, Ohio**
Circle 161 on Reader Service Card

### *HYDRAULIC CYLINDERS . . . have improved key ring assembly*

**Design:** The meehanite rod bearing is long, providing a full one to one surface for extra wear. Chevron type packing is replaced easily and the whole bearing insert is held by merely inserting a locking snap ring at

the rod end. Cast steel mounts are standard equipment and are an integral unit combined with the head and rod caps of the cylinder. These head and mount combinations are easily disassembled by removing the internal locking key ring which unites the head and cylinder wall. There are no bolts used in

this construction eliminating the possibility of loosening.

**Features:** This design permits the cylinders to be the smallest in diameter and length at no sacrifice in strength. Permits a safety factor of 6 to 1 in all bore sizes.

**Sizes:** 1-½ through 8 inch bores with a stroke of any length up to 18 feet. All standard mounts are available.

**Carter Controls, Inc.**
**Lansing, Illinois**

Circle 162 on Reader Service Card

### *NEEDLE VALVE*
### *. . . for working pressures up to 10,000 psi.*

**Construction:** Valve bodies and valve stem guides are machined from heavy bar stock steel, and are joined into a sturdy one-piece construction by an exclusive process. The fusing of the valve stem guide and valve body into an integral unit, rather than

the usual threaded connection, provides a positive leak proof joint. Sturdy valve stems of 416 stainless steel with fine pitch threads have been carefully engineered to permit a close throttling and yet retain the strength necessary to withstand pressures of twice the normal working pressure.

**Application:** For dependable, safe, and accurate control over a wide range of service requirements.

**Jas. P. Marsh Corporation**
**Skokie, Illinois**

Circle 163 on Reader Service Card


# DIAPHRAGMS

## FOR ALL INDUSTRIAL APPLICATIONS

One of Acushnet's many specializations is in the field of diaphragms. We have achieved notable success in the design, development and molding of all types of diaphragms, with or without fabric inserts, from the size of a dime up to three feet in diameter.

Special stocks are expertly compounded with properties to resist various fluids and gases, extreme high or low temperatures, or combinations of these requirements. We are fully equipped to produce rubber diaphragms bonded to metal. Problems involving the most meticulous specifications are invited.

Acushnet
**PROCESS COMPANY**

*Send for a copy of the "Acushnet Rubber Handbook", a comprehensive rubber data reference for molded rubber parts.*

*Address all communications to 794 Belleville Ave., New Bedford, Mass.*

Circle 2 on Reader Service Card

**AT THE START of the operation, this 16 in. bore x 72 in. stroke cylinder, (A) in diagram at bottom, pushes the coil off the turntable on to the powered conveyor.**

# Cylinders Move 25000 lb. Coils

## . . . on mill conveyor system

AT THE U.S. Steel Sheet & Tin Mill in Gary, Indiana, improved efficiency and lower costs for handling heavy coil stock is the result of a carefully laid out conveyor system. Large, heavy coils of sheet steel are pushed, tilted, lifted and pulled down a conveyor line by means of seven special, long stroke cylinders for final positioning on three gravity conveyors leading to the entry end of the pickle lines.

Cranes lift the coils from the storage area in the raw coil pickling department and position them upright on a powered conveyor leading to a turn table. Due to the varying sizes of the coils, an operator turns the table until the coil fits snugly against the pusher head of a mill type air cylinder (A) with a 16 in. bore x 72 in. stroke. This cylinder pushes the coil on to a powered conveyor that carries it to a point where a 2000 psi hydraulic cylinder (B) with a 11 in. bore x 84 in. stroke operates in conjunction with a special tilting mechanism to tilt the coil on its side. The coil now at rest on a dolly at the end of this conveyor is lifted a few inches by a pendulum mounting 2000 psi hydraulic cylinder (C). The dolly is pulled down to one of three gravity conveyors feeding the entry end of the pickle lines by a 2000 psi hydraulic cylinder (D) and an 8 in. bore x 268 in. stroke. Three foot mounted 2000 psi cylinders (E,F,G) with 5 in. bores x 96 in. strokes push the coil off the dolly on to the desired gravity conveyor.

*Courtesy Lindberg Engineering Company*

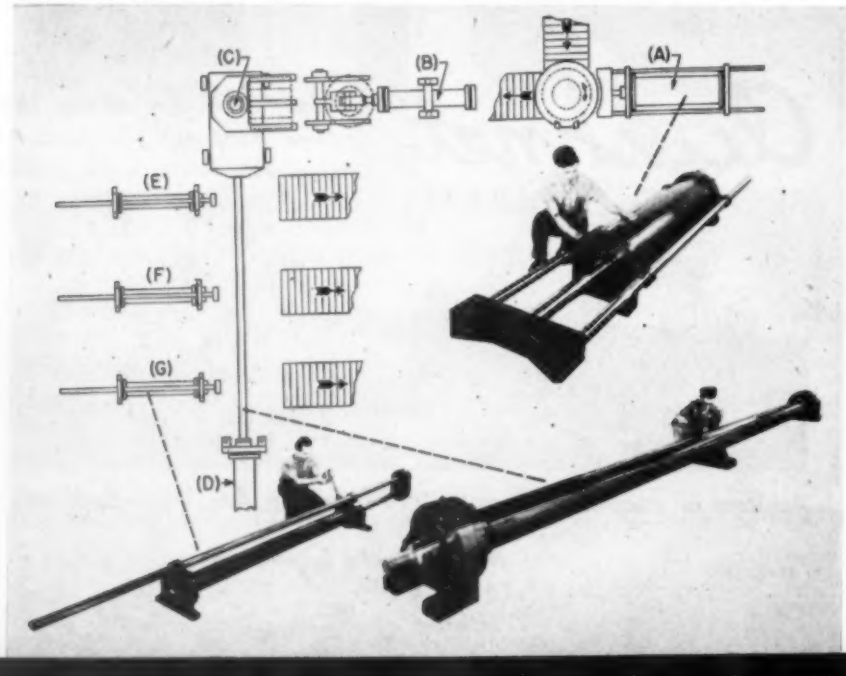



**DIAGRAM of the conveyor system which moves coiled stock from storage to one of three pickle lines. Each cylinder used in this system is illustrated.**

Circle 92 on Reader Service Card

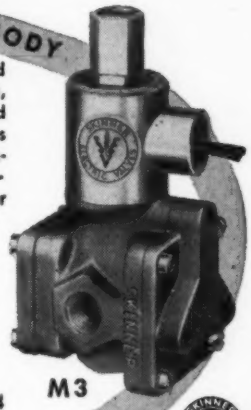
SKINNER

Solenoid Valves

*for* air & hydraulic cylinders
fluid shut-off
diaphragm operated equipment
coolant control

M2

BRONZE BODY



M3

**"M" SERIES** pilot-operated Skinner Valves have extremely fast action, and large capacity on air, inert gas and liquid applications. All internal metal parts are stainless steel or brass. Soft seals prevent leakage — operate in any position — rubber coated, nylon fabric diaphragm for long life — port size ½" or ¾", orifice ¾" — power consumption, 10 watts — continuous duty.

M2 is two-way, normally closed, 5 to 150 p.s.i., weight 3 lbs. M3 is three-way, normally closed, normally open, or directional flow, 20 to 150 p.s.i., weight 3¼ lbs.

*Write for Bulletins* No. 493 & 494

**Skinner ELECTRIC VALVE DIV.**
THE SKINNER CHUCK COMPANY
105 Edgewood Avenue, New Britain, Connecticut

**The Biggest PLUS VALUE in Cylinders**

**For hydraulic pressures up to 1500 or 3000 p.s.i.**

**They're sturdy—dependable—economical**

Use the hydraulic cylinder that will always give you plus performance in your equipment. Designed and constructed to J.I.C. standards, NEPTUNE-POWER PLUS cylinders are available in seven standard mountings—series 1500 for oil and water pressures to 1500 p.s.i.—series 3-1500 for pressures to 3000 p.s.i.

- Bores from 1 to 24 inches —Strokes to 18 feet.
- Pressure ring design permits head rotation to any pipe location.
- Precision fitted piston rings prevent by-pass while offering minimum friction.
- One piece high pressure, self-adjusting, rod packing provides precision bearing and guide for piston rod.
- Single or double end rods, with cushion.
- Other series available for air pressure.

*Write for Catalog AH*

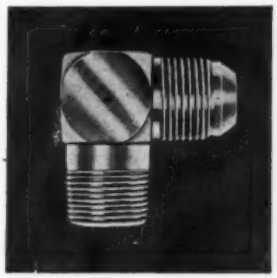
**NEPTUNE-POWER PLUS PRODUCTS CO.**
2228 Bellevue Ave. Detroit 7, Michigan

**L&L STEEL HYDRAULIC COUPLINGS**

*"The Most Complete Fitting Line"*

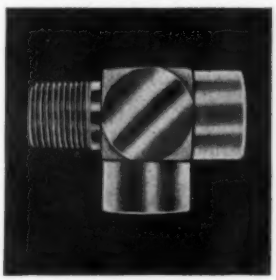
**OUTSTANDING... AND PREFERRED ON ALL INDUSTRIAL HYDRAULICS**

*...Superior Performance*
*...Ease of Assembly*
*...Precision Quality*
*...Large Wrench Flats*
*...Widest Selection of Shapes and Sizes*



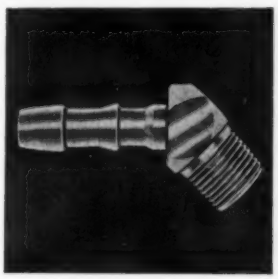
**JIC FLARED TUBE**

- Two or Three Piece
- Sizes ⅛ to 2" Tube
- Square Stock Bodies
- Variable Length Elbows
- Lateral Tube or Pipe Outlets
- Bulkhead Straights – Elbows



**PIPE FITTINGS**

- Steel-Bar Stock
- 3000 PSI Service
- Dryseal Pipe Threads
- Elbows, Tees, Crosses, Unions, Bushings, and Nipples



**MISCELLANEOUS**

- Swivel Elbows
- Restrictor Fittings
- Needle Valves
- Ball Check Valves
- Barbed Hose Stems
- Steel SAE 45° Flare Fittings

*Write today for Catalog*

Representatives in Principal Cities

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8088 EAST NINE MILE RD. • VAN DYKE, MICH.

# USEFUL LITERATURE

**You'll find many valuable production and design ideas in publications described here . . . copies will be sent you free without obligation**

Continued from page 64

**MOTOR STARTERS** . . . Allis-Chalmers size 0-3AC across-the-line motor starters are described in an 8-page Bulletin 14B7132, issued by the company. The bulletin covers manual and magnetic types of starters, combination and reversing starters as well as push button control stations. Operating arrangements are described and three types of enclosures, general purpose, water-tight, dust-tight, hazardous dust location, hazardous gas location and open type, are given. All starters are equipped with thermal overload protection devices and the magnetic starters can be connected for either low voltage protection or low voltage release. A table shows motor voltage and motor maximum hp (3 phase) applicable to each of the four NEMA sizes of starters described.

Circle 183 on Reader Service Card

**HYDRAULIC CONTROLS** . . . Power brake valves, actuators, pressure reservoirs, hydraulic pumps, hydraulic cylinders and other hydraulic units are featured in literature offered by Warner Division of Detroit Harvester Company of N. Y. Inc. All units shown are illustrated and described.

Circle 184 on Reader Service Card

**SOCKET SCREW PRODUCTS** . . . The Standard Pressed Steel Co., has issued a new 4-page folder describing socket screw products manufactured by the company. Included are socket head cap screws, self-locking socket set screws, shoulder screws, flat head socket cap screws and button head socket screws. Also in the folder are descriptions of socket screw keys, square head set screws, pressure plugs and dowel pins.

Circle 185 on Reader Service Card

**FLEXIBLE METAL HOSE** . . . Complete descriptions and specifications for flexible metal hose, fittings and assemblies, are given in catalog, No. 200, published by Titeflex, Inc. Featured in the engineering data section are charts showing frictional losses versus flow rates for various sizes of metal hose and conduit and contains complete information on installation and maintenance. A completely illustrated story shows how seamed metal hose is manufactured, from metal strip to completed assembly. The catalog is well illustrated and a great variety of applications for flexible metal hose is graphically portrayed. Also shown are photographs of production, laboratory and testing facilities.

Circle 186 on Reader Service Card

**VIBRATION ISOLATOR** . . . The Barry Corporation published Product Bulletin 532, presenting complete technical and performance data on the new Type 915 Barrymount. This unit is designed as an isolator of vibration and structure-borne noise from high-speed machinery such as motor generator sets, compressors, grinders, fans and blowers. The bulletin describes typical application practice for these isolators and gives complete data on load ranges, physical dimensions, isolation efficiency at various frequencies, and variation of natural frequency over the range of rated loads.

Circle 187 on Reader Service Card

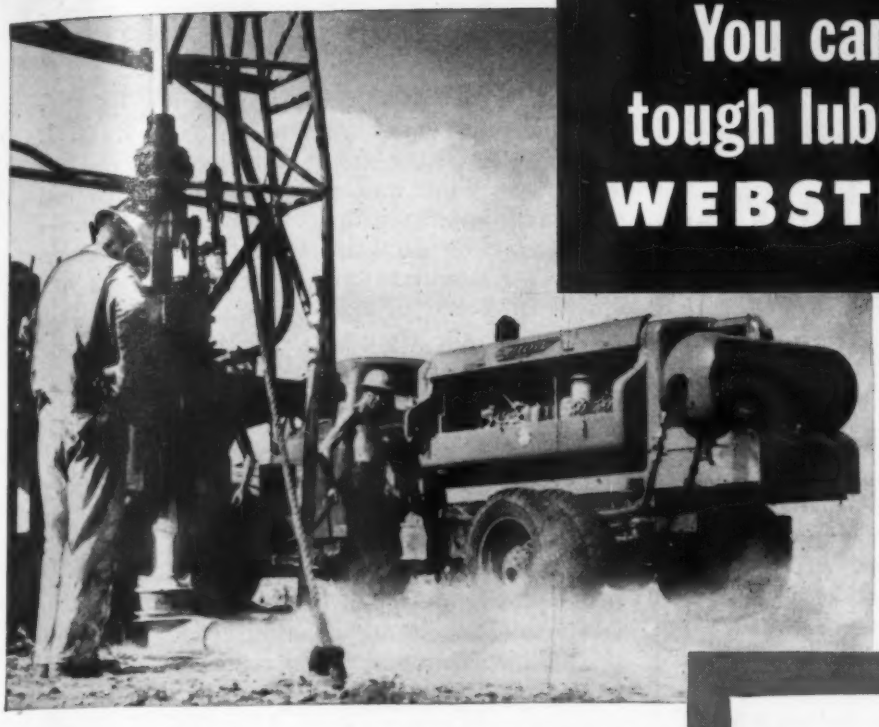
**HYDRAULIC FLUID** . . . An eight page booklet on Lindol H.F., a flame resistant hydraulic fluid has been released by the Chemical Division of Celanese Corporation of America. The hydraulic attributes of Lindol H.F. are stated, physical properties and specifications are listed. Uses, application and installation information are included.

Circle 188 on Reader Service Card

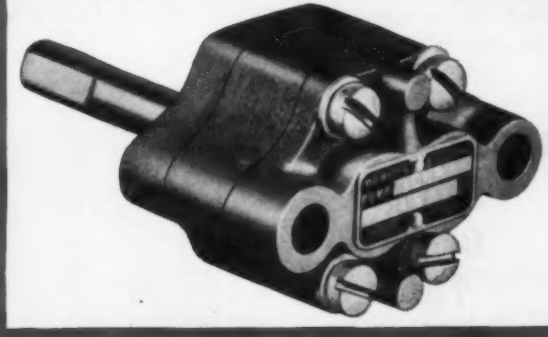
**MOTORS AND GENERATORS** . . . A new consolidated catalog was published by the General Dynamics Corporation's Electro Dynamics Motor-Generator Division. Detailed information on performance, dimensional data, construction advantages, installation photographs and company history have been summarized. Product application information has been simplified into easy to read charts to aid in the selection for motors for ordinary applications of polyphase squirrel-cage induction motors. A special page is devoted to electrical and mechanical modifications that are available for particular installation needs.

Circle 189 on Reader Service Card

# You can trust your tough lubrication job to WEBSTER PUMPS



—A COMPLETE LINE OF GEAR-TYPE HYDRAULIC PUMPS TO FILL A WIDE VARIETY OF APPLICATIONS



## Webster Pumps chosen to furnish lubrication for the Jaeger Air Plus Compressor

• The Jaeger Machine Company's Model 250 Air Plus Compressor is designed to "stand the gaff" of severe conditions—for example, the exploration operation shown above. Here, because of difficulty in obtaining water for mudding shot holes, the Compressors are used to blow cuttings from 5" shot holes, drilled down from 30 to 40 feet—and deliver 250 cu. ft. of air per minute at 100 lbs. pressure!

• WEBSTER Gear-Type Oil Hydraulic Pumps provide these Jaeger Compressors with dependable force-feed lubrication for this unusually tough operation. ... Here at WEBSTER ELECTRIC we make a full line (90 models) of Gear-Type Hydraulic Pumps from 10 gph. to 10 gpm., to operate at pressures up to 1200 psi. at 3600 rpm. or less. Our pumps may be *modified to special installations.*

• Need oil hydraulic pumps for lubricating, oil circulating, filtering, transfer or quiet hydraulic power applications? Consult us, without obligation. Mail coupon today.

**CHECK THESE FEATURES:**

- ✓ Exceptionally compact design.
- ✓ Wide selection of porting locations and mounting methods.
- ✓ Integral relief valve optional.
- ✓ Gear contour carefully selected for quiet operation.
- ✓ Shaft design to accommodate various driving mediums.
- ✓ Engineered and precision-built for economical performance.
- ✓ All materials carefully chosen for durability.
- ✓ Design permits use in pumping other liquids having a substantial oil base.

Oil Hydraulics Division, Webster Electric Company
Dept. AH-8, Racine, Wisconsin

Send me information on WEBSTER Hydraulic Pumps as checked:

Capacity (approx.) _____ G.P.M.
Pressure (approx.) _____ P.S.I.
Pump Speed _____ R.P.M.

Name and Title _____

Firm Name _____

Street Address _____

City _____ Zone _____ State _____

OIL HYDRAULICS DIVISION

**WEBSTER ELECTRIC**

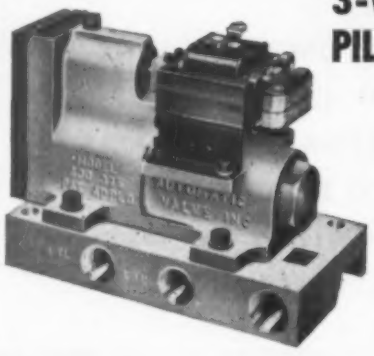
RACINE WISCONSIN

"Where Quality is a Responsibility and Fair Dealing an Obligation"

WEBSTER ELECTRIC COMPANY, RACINE, WISCONSIN • EST. 1909

*Fast-Rugged-Dependable*

**AV AIR CONTROL VALVES**



**3-WAY..4-WAY PILOT OPERATED VALVES**

Short operating stroke gives exceptionally high speed performance.

Uses small, low-power, nationally-known solenoids.

Small, compact, made with non-corrosive materials. 3-way (norm. open or closed) and 4-way operation full port sizes ¼", ⅜", ½" and ¾".

**3-WAY... 4-WAY SOLENOID OPERATED PILOT VALVES**

Direct acting—¼" pipe tap for pressures to 150 P.S.I.

Light aluminum construction.

Operates master valves, or small cylinders up to 3" in diameter.

**SPEED CONTROL VALVE**

Efficiently controls speed of piston rod of cylinder. Restricts air being exhausted from cylinder.

Used on air or hydraulics —pressures to 1200 P.S.I.

Sizes ¼", ⅜" ½" and ¾".

*Write for bulletin and attractive O.E.M. and quantity discounts*

**AUTOMATIC VALVE CO.**

37419 Grand River Ave.

FARMINGTON, MICHIGAN


## USEFUL LITERATURE

**TEFLON PACKINGS** . . . Reid Enterprises has prepared some data sheets on Teflon spiral back-up rings, which are now being used to replace leather back-up washers. All dimensions and specifications are outlined. One folder describes the production facilities to meet your requirements for standard and special products and illustrates some of the special products manufactured by the company.

Circle 190 on Reader Service Card

**RUBBER DATA** . . . A 32-page two colored catalog describes the facilities and products of the Acushnet Process Company. The catalog's first part is devoted to production facilities and a pictorial tour of the plant is presented. The second section deals with representative items of their production, featuring diaphragms, silicone rubber parts, rubber-to-metal bonded parts, O-rings and seals and many others. Typical testing methods are illustrated and data, specifications and general properties of various rubber compounds are listed.

Circle 191 on Reader Service Card

**AIRCRAFT ACTUATORS** . . . Aeroproducts, Allison Division of General Motors Corp. illustrates the self-locking hydraulic actuator. A schematic drawing shows a basic design, infinitely variable for hydraulic, pneumatic, electric or manual operation, which may be used to control any part of an aircraft or powerplant that moves. The actuator may utilize the power of a hydraulic or pneumatic system or both. It can be basically electric with an emergency pneumatic boost. All the parts and features are highlighted and applications shown.

Circle 192 on Reader Service Card

**HOSE COUPLING EQUIPMENT** . . . Suppliers of hydraulic hose can now buy their hose in bulk, cut it to required size as needed, and couple it in their own shop. The hydraulic hose coupling shop, made by Champ Industries, Div. of Hose Accessories Co., shows in a 4-page brochure how it allows the supplier to maintain a smaller inventory of hose and at the same time a complete range of sizes from stock. A complete self contained unit which includes cut-off, skinning and hydraulic press sections. The unit will make up single or double braided hose from ¼ to 1¼ inches, total assembly time averaging about five minutes for any length of hose.

Circle 193 on Reader Service Card

Circle 117 on Reader Service Card

# AIR-HYDRO-PUMP

*produces and holds*

**27,200 PSI**

**Hydraulic Pressure**

**(air required—100 lbs. psi)**

- Air-Hydro-Pump is the world's finest pressure unit for rapid testing of Valves, Boilers, Piping, Pressure Vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis and Acids can be used.
- Made of non-ferrous metals.
- Fully automatic, holds any pressure indefinitely.
- Complete range of 34 models single or double acting.

*High Pressure Control Valves to 30,000 p s i Also Available*

WRITE FOR DETAILS

**DAVIES BROS.** 120 WALL STREET NEW YORK 5, N. Y.

PUMPS FOR EVERY ENGINEERING NEED

Circle 62 on Reader Service Card

COMPRESSED AIR AND GAS COME OUT OF THE LOGAN

# ARIDIFIER

*Scrubbed* CLEAN AND DRY

INSTALL ARIDIFIERS ON LINES SERVING

- Paint Spray Guns
- Air Tools
- Air Hoists
- Foundry Jolting Machines
- Sand Blasting Tools
- Sand Blasting Rooms
- Metal Spray Guns . . . or Wherever the line must deliver clean, dry air or gas

On any air or gas line 92% of the dirt, oil, scale and water that enter the Aridifier is trapped and removed from circulation. The Aridifier's patented centrifugal-baffle action scrubs air and gas clean and dry . . . protects equipment, prevents freezing, fouling, corrosion and caking, produces best results with spray gun and air tool operations, etc. Easy to install. Self cleaning. Maintains itself. 10 models available. Capacity 7 CFM to 17,000 CFM.

Learn HOW the Aridifier scrubs with a patented centrifugal-baffle action.

**Write for This Catalog**

**Now!**

**Logan ENGINEERING CO.**

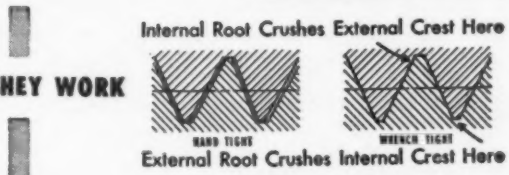
**4920 W. Lawrence Ave., Chicago 30, Ill.**

# UNBRAKO®

**dryseal-thread**

**PRESSURE PLUGS**

**HOW THEY WORK**




In tightening of UNBRAKO Pressure Plugs, the roots of the flattened threads actually crush the sharper crests of the mating parts. Major and minor diameters are positively sealed, pressure tight without compound. Stocked and sold by leading industrial distributors everywhere. Write for literature. SPS, Jenkintown 2, Pennsylvania.

*Our Fiftieth Year* : A START FOR THE FUTURE

**UNBRAKO SOCKET SCREW DIVISION**

**SPS**

**JENKINTOWN PENNSYLVANIA**

**Sperry**

# *Hydraulic* REMOTE CONTROLS

FOR AUTOMOTIVE, RAILROAD, MARINE, MACHINE TOOL and COUNTLESS OTHER APPLICATIONS

*For example-* **AUTOMATIC SPEED CONTROL**

for spools, wind-up drums and other similar devices compensates for increasing diameter of material. Adaptable to a wide variety of machines and products.

- POSITIVE, ACCURATE DUPLICATION of MOVEMENT
- COMPLETELY SELF-CONTAINED, INDEPENDENT
- SINGLE TUBE—EASY INSTALLATION • INSTANT RESPONSE • RUGGED and DEPENDABLE

WRITE NOW FOR COMPLETE INFORMATION or send prints and specs for special applications.

**SPERRY PRODUCTS, INC.**

708 SHELTER ROCK ROAD,

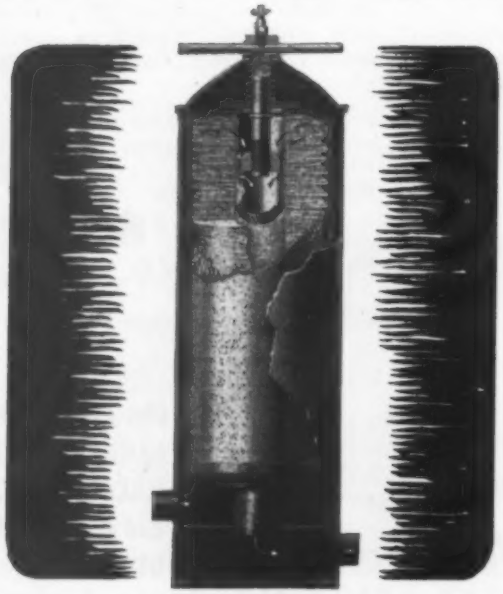
**Danbury, Connecticut**

REPRESENTATIVES IN PRINCIPAL CITIES

August, 1953 Circle 97 on Reader Service Card

Circle 94 on Reader Service Card

# Prevent
## Sludging
## Pump, valve and piston failures
*with*
# HILCO
# OIL FILTERS



SERIES "R" FILTER

**Oil contamination is one of the largest single causes of hydraulic equipment failure. Eliminate dirty oil with HILCO filters . . . keep your oil clean by removing products of oxidation, acids, sludge and moisture. Increase the life of your oil and cut costly downtime with HILCO filters.**

**Years of experience and dependable service make HILCO your best filter buy.**

***★ Recommendations at No Obligation***
***FREE Descriptive Bulletin***

**THE HILLIARD CORPORATION**
148 W. FOURTH ST. • ELMIRA, N. Y.

**IN CANADA: — UPTON - BRADEEN - JAMES, LTD.**
**990 Bay Street, Toronto — 3464 Park Avenue, Montreal**


## USEFUL LITERATURE

**PACKINGS** . . . New York Belting and Packing Co. has prepared a very attractive 40 page catalog describing their products. The brochure contains much valuable information on the care, use and maintenance of rod and sheet packings and gaskets. A complete section in the back of the book contains all the necessary charts and tables for determining the working specifications of packings. To help in determining and specifying correct packing for industrial applications there are two pages of packing recommendations, covering general industrial services and refinery operations.

**Circle 196 on Reader Service Card**

**SMALL ELECTRICAL SWITCHES** . . . Hermetically sealed precision switches are the subject of a 4-page brochure prepared by Haydon Switch Company. Classified as a sensitive snap action type, this rugged little switch is claimed to be the answer to any problem where ice, dust, humidity, oil, grease, water and a number of other elements cause ordinary switches to fail. Mounting dimensions are illustrated and general specifications listed.

**Circle 197 on Reader Service Card**

**TUBING STRESS DATA** . . .Engineers associated with the design of equipment operating under stress at high temperatures over long periods of time will be interested in a data card TDC-153, published by the Tubular Products Division of The Babcock & Wilcox Company. The card presents stress rupture data on a number of Croloy tubing steels and other materials designed for high temperature service. Data developed by stress-rupture tests offer an important means of evaluating the characteristics of metals for operation under stress at high temperature over long periods of time.

**Circle 198 on Reader Service Card**

**DRIVE COMPONENTS** . . . To introduce five new friction and hydraulic drives for powered equipment used in the major industries, Twin Disc Clutch Company has released a special 16 page New Products issue. The new drives and the purpose of their development include a two stage hydraulic torque converter, to fill the gap in industrial hydraulic drives; a new 2-speed transmission, to obtain extended full range performance from three stage torque converters; a new disconnecting hydraulic power take-off, to provide a higher capacity, more compact disconnecting fluid drive for powered equipment. Also included is a new air-actuated clutch, offering lighter weight and more narrow clutch width

with higher torque capacity and a new oil-actuated multiple plate clutch, incorporating an integral cylinder to eliminate adjustment and provide constant torque capacity, more compactness, longer wear life and adaptability to remote control. All the new components are illustrated and application photographs are shown.

Circle 199 on Reader Service Card

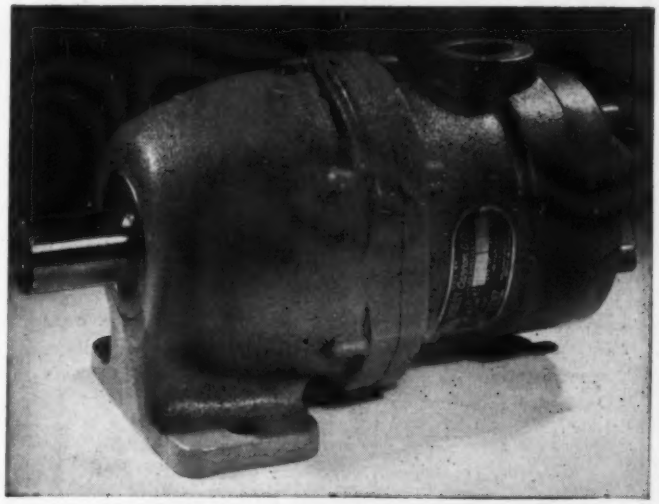
**AIR COMPRESSORS** . . . Pennsylvania Pump and Compressor Company prepared a comprehensive 6-page Bulletin 546, which describes briefly its line of air and gas compressors, dry vacuum pumps, aftercoolers, centrifugal pumps for boiler feeding, general power plant and industrial applications. The catalog contains pictures of each member of the Pennsylvania line together with a description, capacities and sizes.

Circle 200 on Reader Service Card

**AIR CYLINDERS** . . . Double acting air cylinders manufactured by Lehigh Foundries Inc., are detailed in a four-page folder. These cylinders are compact in design, square ends permit close mounting without interference with surrounding or moving equipment. The piston rod seal is of the self adjusting leather flange type impregnated with Neoprene compound. The cylinders are available in bore sizes from 1½ to 12 inches.


Circle 30 on Reader Service Card

**DUDLEY "NUTATING PLATE" OIL HYDRAULIC HYDRAULIC MOTORS**



**Series 625—1½—11¼ GPM—0 to 1,000 PSI**

Used by leading manufacturers as standard equipment. Proved by over 4 years of successful performance. No gears; no vanes; no cams or ball joints. Self-adjusting for all viscosities, temperatures and pressures. Write for bulletin, and name of nearest representative.

**EASTMAN PACIFIC COMPANY**

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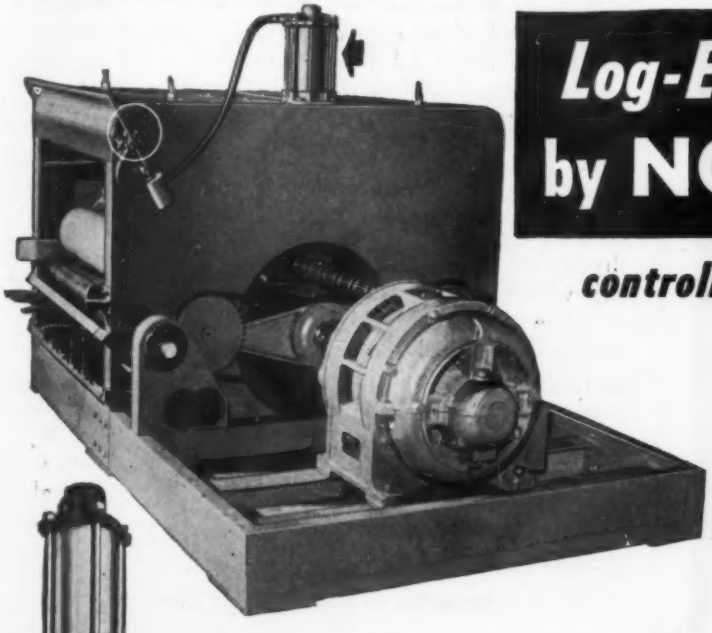
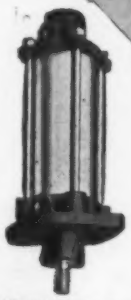




NOPAK Model "D" Air Cylinder for Right Angle Flat Base Mounting, Rod End.

Refer to Sweet's File for Product Designers or write for Bulletin SW-1.

***Log-Edger Feed-Rolls* lifted by NOPAK Cylinder**

***controlled by* NOPAK 3-Way Air Valve**

This Pacific Coast type log edger, manufactured by Albany Machine & Supply Co., Albany, Ore., employs an 8" NOPAK Model "D" Single Acting Air-Cylinder to lift the heavy feed-rolls by means of lever arms. This permits feeding of various sized cants as required. The cylinder is actuated by a 3/4" NOPAK, 3-Way Air Valve, equipped with lever extension-bar enabling the operator to manipulate it from any point in front of the machine. Weighted valve lever, when released, lowers rolls to "feed" position. Heavy springs prevent the feed rolls from dropping full length of cylinder stroke when machine is "empty."

This comparatively simple application may suggest how you can employ NOPAK Valves and Cylinders in your plant or product to actuate and control machine movements.

**GALLAND-HENNING NOPAK DIVISION**

2743 S. 31st STREET • MILWAUKEE 46, WISCONSIN

**NOPAK**

**VALVES AND CYLINDERS**

**DESIGNED for AIR and HYDRAULIC SERVICE**

*Representatives in Principal Cities*

Circle 113 on Reader Service Card

## An adjustable FLOW REGULATOR

This newly perfected adjustable Flow Regulator holds at a constant rate even though the pressure fluctuates.

The valve controls adjustably in one direction and permits uncontrolled return flow.

The spring back piston in the housing is mounted in front of the adjustable screw. It carries a calibrated orifice; operates axially on change in inlet pressure so as to increase the throttling action.

Four sizes, 1/4, 3/8, 1/2, and 3/4 inch. Overall length, 4 1/2 to 7 1/2 inches. Adjustable over a 50% flow range. Maximum pressure is 3000 pounds.

*Write for illustrated circular A*

WATERMAN ENGINEERING Company
725 CUSTER AVENUE
EVANSTON, ILLINOIS

BOOST PUMPS

Boost 100 PSI. air pressure to 10,000 PSI, fluid pressure for $173.25 (FOB Gardena, Calif.). Eight standard models for output fluid pressures of 1,000 to 30,000 PSI. Special models for lower or higher pressures.

Applicable wherever low volume output at high pressures is the requirement. For oil or water service. Complete power packages also available. Send for bulletins.

SPRAGUE
Engineering and Sales Corp.
1144 West 135th Street, Gardena, California

## USEFUL LITERATURE

maximum 200 psi air pressure. May also be used as light hydraulic cylinders at maximum 500 psi hydraulic pressure. Mounting styles are illustrated and dimensions given.

Circle 201 on Reader Service Card

**BELT DRIVEN PUMPS . . .** Tuthill Pump Company issued an 8-page bulletin describing the Type SU pumping unit for handling heavy fuel oil and other non-corrosive viscous liquids. Ball tension adjustment, ball bearing pillow blocks, fiexible coupling are some of the features incorporated in this improved design, all of which are illustrated, part diagrams, dimensions and specifications shown.

Circle 202 on Reader Service Card

**GENERAL PURPOSE STARTER SELECTION GUIDE . . .** Tips on selecting the right starter for squirrel-cage induction motors rated up to 600 hp at 600 volts or less are contained in a new bulletin released by Allis-Chalmers Manufacturing Company. The bulletin tells how to select the proper type starter, enclosure and operating arrangement, and explains how to determine whether a full or reduced voltage starter should be used. An outline of two or three-wire control and hints on the selection of heater elements for overload relays are also given in the bulletin along with a cage motor selection chart.

Circle 203 on Reader Service Card

**LIQUID-LEVEL CONTROL . . .** A single-thyratron electronic liquid-level control operating without radio frequency from a single capacitive type probe is described in a 48-page folder, Form 114-453, issued by Thermo Instruments Co. This publication illustrates the single-unit control, the probe, and alternative schematic arrangements for installation. Absence of moving or contact-making parts is related to applications in the refrigeration, petroleum and chemical fields. Specifications of various styles are included.

Circle 204 on Reader Service Card

**HYDRAULIC OILS . . .** Physical properties and advantages of Solnus Oils, produced by Sun Oil Company, are discussed in Sunoco Technical Bulletin No. 17. Application to a wide variety ot industrial equipment is one of the most important advantages, the bulletin states, and excellent performance for longer periods of time can be obtained from these oils because they have been stabilized to resist the destructive forces

of oxidation. A graph compares the time-temperature characteristics of Solnus with two other general purpose lubricating oils.

Circle 205 on Reader Service Card

**PRESSURE SEAL . . .** An 8-page bulletin offered by Sealol Corporation describes the balanced pressure feature of the seal. The balanced pressure feature results from the use of the differential area principle which eliminates the need for high spring loading and allows a close control over face pressures under all conditions of operation. Engineering drawings, specifications, installation and design data are included in this catalog.

Circle 206 on Reader Service Card

**LIQUID FILTERS . . .** Full flow filtration of lubricating, hydraulic and fuel oils is the main feature of liquid filters described in a 12-page bulletin released by Air-Maze Corporation. This filter is characterized by a simplified and sturdy design. Individual filter discs are stacked over a perforated center tube forming the complete filter element. A cut-away drawing shows the internal construction of a standard model. Various models are illustrated, their features, dimensions and capacities given.

Circle 207 on Reader Service Card


Circle 73 on Reader Service Card

4 ADVANCED FEATURES OF

NICHOLSON AIR TRAPS CUT MAINTENANCE

For promoting positive drainage of after-coolers, receivers, etc., these Nicholson weight-operated air traps are increasingly recommended, due to 4 features:

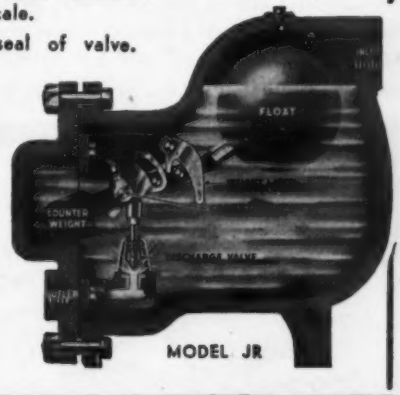
1) Exclusive new oil-eliminator prevents common problem of oil congealing on mechanism and impeding or stopping its action.

2) Larger valve orifice minimizes trouble from dirt, scale.

3) Positive water seal of valve.

4) Special hardened stainless steel valve makes reseating seldom necessary.

Three types; pressures to 1500 lbs.



MODEL JR

Catalog 751

213 Oregon St., Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Here's The New Gre-Sen Hydraulic

DIFFERENTIAL RELIEF VALVE

Another Gre-Sen Quality Product at Mass Production Prices.

Features

★ Hardened Steel Plunger and Seat

★ Smooth Operating Pressure Regulating Screw

★ Light Spring Has Long Life and Low Stress

★ Grey Cast Iron Body

Series D.R. Relief Valves are available in three pressure ranges.

Model D.R.—75-A—Pressure Range— 100 to 500 P.S.I.
Model D.R.—75-B—Pressure Range— 500 to 1250 P.S.I.
Model D.R.—75-C—Pressure Range—1250 to 2500 P.S.I.

Write for Literature

GRE-SEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-83 Minneapolis 11, Minn.

The Higher the Pressure ...the Tighter the Valve

On hydraulic presses of all types this Yarway Hydraulic Valve will give long life with minimum maintenance. Automatically regrinds its own sealing surfaces. Small and compact. Easy to install and operate.

Yarway Single-Pressure Hydraulic Valves are made in straightway, three-way and four-way types; in five sizes for pressures up to 5000 lbs. Also Yarway Two-Pressure Valves in two sizes for pressures up to 5000 lbs. Write for Bulletin H-210.

YARNALL-WARING CO.

133 Mermaid Ave., Philadelphia 18, Pa.

YARWAY

Improved Type HYDRAULIC VALVE

# WANT THIS NEW CATALOG?

## NEW ASCO CATALOG

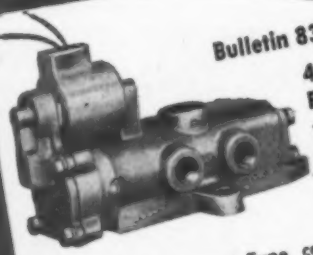
*Describes Scores of Solenoid Valves*

New Valve Catalog No. 24 brings you up-to-date on the extensive ASCO line of Solenoid Valves (list prices are included). New valves developed and put on the market recently are described in detail *for the first time*. A few of these are:

**Bulletins 8262 and 8314**
**Midget Size**
**2 & 3-Way Packless Solenoid Valves**

Midget Valves are now available with EXPLOSION-PROOF Solenoids for Class 1, Group D hazardous locations.

2-Way (Normally Open or Normally Closed) — Ports, 1/16" through 3/16"; pressures up to 1000 p.s.i. 3-Way — Ports, 3/64" and 3/32"; pressures up to 125 p.s.i. Time Delay Feature — Valves with 3½-6½ seconds delay also available.



**Bulletin 8344**
**4-Way POPPET TYPE Packless Solenoid Valves**

This valve has been thoroughly tested as a control unit in equipment requiring "plus" performance. Valve features:

**Reliability** — Poppet Type construction means this valve will not stick! Power stroke occurs in both directions — no spring return!

**Fast Operation** — 500 cycles/minute continuous duty; 750 cycles/minute intermittent duty (air).

**Freedom in Mounting** — Can be mounted in any position. Available 4 and 5 port; flow metering; standard or manifold mounting; ⅜, ½, ¾, and 1 inch pipe size. Handles air, water, or hydraulic oil; maximum pressure 250 p.s.i.

These two are just examples of new valve data. If you have any need for controlling the flow of liquids or gases in the equipment you are designing or operating, you should find this up-to-date ASCO Valve Catalog useful. Want a copy? Just drop us a note or call up and let us know. We'll be glad to send it to you . . . and extras for your associates if you desire.

ASCO Solenoid VALVES

We manufacture a complete line of Electromagnetic Controls including Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and complete Control Panels.

V. 83.1

**Automatic Switch Co.**

385 H LAKESIDE AVENUE • ORANGE, NEW JERSEY


# Development of "O" Rings

Continued from page 86

packings which would give consultant results. The test machine now in use is a reliable means of predicting "O" ring performance in actual service.

### *Cold Weather Operational Tests*

In the winter of 1942-1943, cold weather operational tests of military aircraft in Alaska proved that "O" ring compounds were generally satisfactory down to –40 F. Some unknown compounds would "freeze" at –20 F. Some rings could be made more resilient and would function at lower temperatures by increasing the squeeze of the "O" ring. This fact led to the use of the V-shaped groove for the "O" ring. See Figure 3.

This groove increased the squeeze on the "O" ring because of the wedging effect of the groove. The freezing point of the "O" ring compound could be lowered several degrees when used in this groove, although it did cause higher friction on the "O" ring and was more difficult to install than in a rectangular groove. However, the V-groove was discontinued because of the installation problem, high friction and the stresses it produced in –65 F compounds which are in use today.

As a result of the Alaskan cold tests, specific recommendations were made to prevent "O" ring failures at extreme low temperatures:

(a) "O" ring compounds must function at —65 F.

(b) A test of a compound should be made after a cold soak of —65 F. for a minimum of 24 hours, preferably 72 hours, at zero pressure.

(c) The policy of using only approved compounds to Specification AN-HH-P-114 be emphasized.

By the summer of 1943, some –65 compounds had been approved. These were Neoprene GN stock, and a blend of Neoprene FR and Buna N stocks.

Considerable work was done in 1943 on the development of a suitable packing for 3000 psi hydraulic systems. It was found that it would be necessary to develop a non-extrusion device in order to prevent early failure of the "O" ring packing. This search was a development program in itself and resulted in the present standard leather back-up rings, AN 6246 and AN 6244 for use as non-extrusion devices with AN 6227 and AN 6230 packings, respectively, at pressures which exceed 1500 psi.

In the spring of 1944, the services were deluged with unsatisfactory reports of "O" ring failures, apparently by differential twisting of the "O" ring in its groove and strain aging. Figure 4 shows a characteristic spiral failure of an "O" ring. The first "O" ring compound using only Buna N stock, introduced this same year, appeared to have a better resistance to spiral failure than previous compounds. However, spiral failure continues to be a critical problem especially in shock strut applications.

A meeting at Wright Field in October, 1945, attended by Army and Navy representatives, packing manufacturers, fluid suppliers and members of the aircraft industry, resulted in the formation of an advisory group known as the Technical Advisory Committee on

Hydraulic System Materials. The function of this group was to coordinate information relative to fluid and packing problems and to act in an advisory capacity to the S.A.E. A-6 Committee.

In the same year, Specification AN-P-79 replaced AN-HH-P-114. This spec included new tests for corrosion and spiral failure control. A crush test was devised which gave good correlation in predicting spiral failure tendencies of a compound. The test consists of "crushing" "O" rings between metal plates which are leaded by a constant external pressure for a given period of time and cataloging the effects of this crush load on the "O" ring.

The packing manufacturers then had the difficult problem of producing a compound which would resist the crush load test and still be cold resistant at —65 F. The result was a compromise in compounding which would yield the best overall results.

In 1945, Specification AN-P-74 was issued defining installation procedures and gland design for "O" rings. This specification was a compilation of actual experience and presented recommendations to obtain the optimum service from "O" ring packings. Gland dimensions for 3000 psi were also included. The length of the "O" ring groove for 3000 psi applications was increased over that of the 1500 psi groove length in order to accommodate the leather back-up rings used as non-extrusion devices.

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The "O" ring possesses a number of basic advantages. It simplifies sealing design problems; the "O" ring is relatively simple to manufacture and service; and, with proper installation, it virtually eliminates the human factor.

While this article is limited largely to hydraulic systems, it should be remembered that the applications of "O" rings to pneumatic aircraft system is of steadily increasing importance. Pneumatic systems on aircraft are newer and, at present, far fewer than hydraulic systems. The lag in pneumatic research and test programs is rapidly being taken up.

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A development contract, sponsored jointly by the Army and Navy in 1946 was given to Battelle Memorial Institute, Columbus, Ohio. A comprehensive study of "O" rings and related problems was made; this included an extensive study of friction characteristics, plasticizers in "O" ring compounds, the mechanics of spiral failure and resulted in specific recommendations for changes in the packing specifications. Since this time only minor changes have been made to existing specifications. The state of the art was such that the "O" ring has been universally accepted as a satisfactory packing.

Today packing manufacturers are working on compounds that will greatly exceed the present specification limit of 160 F. Friction studies are being continued in order to be able to predict friction forces on packings in various design parameters. Spiral failures are now reproduced in the laboratory; further work is seeking causes and cures for spiral failures which still occur. New non-extrusion devices to protect the "O" ring at higher operating pressures and temperatures are being introduced.

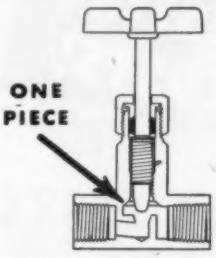

Circle 65 on Reader Service Card

New
MARSH
Needle Valves

MAXIMUM WORKING PRESSURE 10,000 PSI

. . . for finer regulation of water, oil or gas

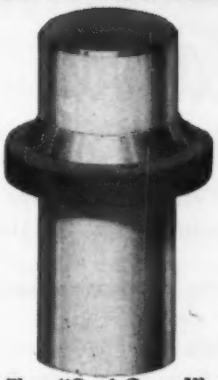
First needle valve to combine all the characteristics called for in modern industry. Embodies sturdiest basic construction—machined from solid bar stock—suitable for pressures to 10,000 psi and equally efficient in lower range. Note stem guide fused to body by new "Conoweld" process, eliminating faults of conventional two-piece valves. Stem 416 stainless steel. Stem threads fine pitch for strength and micrometer regulation. Body electro-zinc plated. Sizes ⅛" to 1", globe and angle patterns.




Ask for new Needle Valve Catalog

MARSH INSTRUMENT CO. Sales affiliate of Jas. P. Marsh Corporation
Dept. 19, Skokie, Ill.

"SEAL-GUARD"
METALLIC ROD WIPER



PROTECTS YOUR CYLINDER RODS, MACHINE SPINDLES, GUIDE PINS AND LOCATING PINS

The "Seal-Guard" Metallic Rod Wiper affords permanent protection from falling or flying debris . . . Two flexible bronze rings mounted in synthetic rubber lift off harmful substances completely by means of their knife-edged conical surfaces . . . The device is self-adjusting through action of rubber on staggered scraper rings . . . Rod diameter sizes are from ½ to 10 inches.

Write for Literature

HYDRAULIC ACCESSORIES CO.
24301 HOOVER RD. • VAN DYKE, MICHIGAN

CENTURY TESTS
ALL HYDRAULIC PUMPS
AND VALVES (NEW AND REBUILT)
ON 1 TEST STAND!

Check the Features

- Flexible coupling takes different size pumps
- Work table for pump mounting with "T" slot—8" vertical adjustment
- Adjustable to allow testing of pumps having shaft heights up to 12"
- 200 gal. reservoir with drip tray
- 10" visual flow meter for flow rates from 0–60 G. P. M.
- Test gauge 6" Dial 0–2000 psi. range
- 1½" relief valve 0–2000 adjustable range
- Filter unit to clarify oil
- 4 way hand-operated hydraulic directional valve
- 30 H. P. motor with AC Combination starter

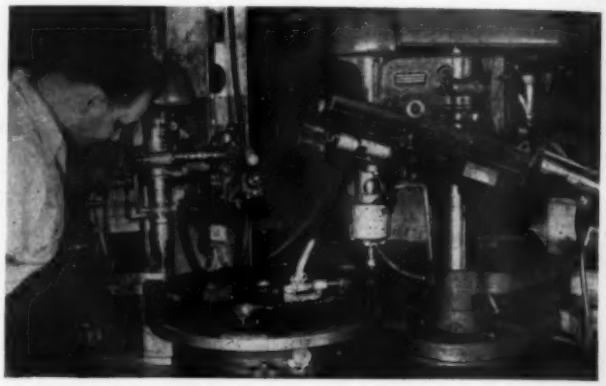
*Meets All J.I.C. Standards*

CENTURY HYDRAULICS, INC.
18135 JAMES COUZENS HIGHWAY • DETROIT 35, MICHIGAN

# Air Automates Drilling and Tapping

HOTPOINT, INC. is constantly searching for ways to improve their production schedules and keep their costs at rock bottom levels. They pay particular attention to "second operation machining" for here, they know, substantial savings can be made.

Typical of their approach was their method to reduce the production time in drilling and tapping eight ¼ inch holes in a heavy, cast iron ring. Formerly these eight ¼ inch holes were drilled and tapped by one manually operated, single spindle drill press—taking 12 minutes to complete one piece of work. This troublesome manual operation has been changed into one that is smooth, fast and automatic.



**SPECIAL MACHINE uses air drill and tapping feeds and a rotary air feed table.**

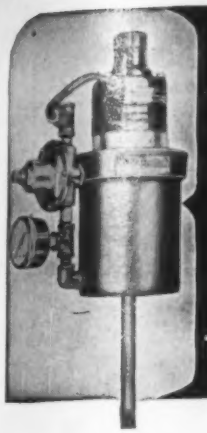
*Courtesy The Bellows Co.*

Two drill press feeds and a rotary feed table, combined with two standard drill press heads, enabled Hotpoint to cut the floor to floor time on the operation from 12 minutes to 2 minutes, 43 seconds. Production is a steady 23 pieces per hour—more than 4½ times as fast as before. Operation is almost fully automatic with the work of the operator reduced to loading, pushing the start switch, and unloading.

Two features of this operation are of particular interest. The sequence of action is arranged to take full advantage of the fact that the tapping speed is many times faster than that of drilling. It takes 93 seconds to drill the eight holes and tap the first four, but the last four holes are tapped in only 17 seconds. The rotary feed table makes one and one half revolutions for the complete operation, a total of 12 indexes on an eight position table. The first nine indexes are controlled by the drill unit, the last three indexes of the table by the tapping unit.

The switching of control from drill unit to tapping unit is handled by the ingenious use of riser cams on ratchet gears. These cams as they are rotated by one way dogs, control two limit switches which complete the tapping circuits at the precise instant demanded for maximum speed of operation. In order to properly time the micro switches, the degree of rise on the cams themselves must be calculated exactly and machined correctly.

Circle 23 on Reader Service Card



## Up to 5 times faster response with NEW CONOFLOW PNEUMATIC CYLINDER MOTORS for THROTTLING CONTROL

The New B-50 Series of pneumatic cylinders for throttling control service operate on air pressures up to 100 psig and are capable of repositioning accuracies of 1/500 part of total stem travel. Simplified one-piece piston construction features graphite impregnated "O" ring seals and a piston positioner integrally mounted in the head plate. Extra sensitive, speedy and stable—because of minimum friction and precisioned aluminum design.

Many applications include positioning electrical components, variable speed drives, rubber pinch valves, etc. Available in 4", 6" and 8" diameters with 3" and 4" stem travels. Furnished complete with cushion-loading regulator and gauge, fully piped, ready for installation.

**Write for bulletin B-50-AH.**

**CONOFLOW CORPORATION**
**2100 Arch St., Phila. 3, Pa.**

Cono Controls

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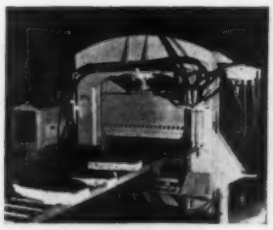
Circle 18 on Reader Service Card

PROMPT SERVICE—LOW COST

## Flexible—Dependable High, Medium And Low Pressure HYDRAULIC HOSE ASSEMBLIES

- **Flexible Hydraulic Control Lines.**
- **High Pressure, Wire Braided Hose Assemblies Withstand Flexing, Vibration and High Pressure Surges from 800 to 5,000 P.S.I.**
- **Hose Thoroughly Resistant to all Hydraulic Fluids.**
- **Carlyle Hydraulic Hose Assemblies are Fabricated to Exact Pressure, Length and Coupling Requirements.**
- **Shipment of Hose Assemblies are made Same Day Order is Received.**



*• Send for Hose Assembly Catalog. Available upon Request.*

**CARLYLE RUBBER COMPANY INC.**
62-64 Park Place, New York 7, N. Y. • DI-gby 9-3810

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SAVE UP TO 85%
WAR SURPLUS SAVINGS
NEW INSIDE – OUTSIDE VERNIER CALIPERS
German made by one of Europe's leading specialists in precision tools. Measures inside-outside & depth in .001" to 6" in 1000ths and 1/10mm to 150mm in 10ths. ..... 9.75
MICROMETERS – 0" to 1" in 1,000ths. Has lock-nut & ratchet ...ONLY – ... 9.75
STAND MAGNIFIER
Handy stand magnifier with universal adjustments. Overall height 6". Has powerful, clear magnifying lens. 1.99
BENDIX HYDRAULIC PUMP & MOTOR
Has 3-1/2 GPM capacity at 600 PSI. Motor is 1½ HP, 24V, D.C. Will operate on either 12 or 32V, DC current. Has built-in relief valve adj. to 1500 PSI. This unit ideal for hyd. lifts, portable loaders, etc. ..... 19.50
MAGNETIC BASE-INDICATOR HOLDER...
A time saver for precision checking. Magnetic base fits curved or flat surface. Has 45-50 lb. pull. Stainless steel 6½" rod mounted in ball socket permits universal settings 3.95
Note: We have complete line of instruments, depth gauges, inspection mirrors, etc. WRITE TODAY
HYDRAULIC HAND PUMP
Operating pressure 2000 PSI. Cap., 1.5 cu. in per complete cycle ... 12.75
GEAR HEAD MOTORS
Heavy duty, G.E. Gear Head motor. 2 HP, 24V. DC, 125 amp., reversible motor drives a reduction gear unit giving 36 to 1 ratio at take-off. Also will operate on 6 or 12 volts.
36 to 1 G.E. (306 shaft RPM)
28 to 1 Eclipse (130 shaft RPM)
40 to 1 Eclipse (110 shaft RPM) 10.95 EA.
HYDRAULIC ACCUMULATORS
A-2B FLOATING PISTON TYPE – 4"x 18" Built to stand 2,000 PSI 12.75
A-5 VICKERS – 10" dia. Ball type. Built to stand 2000 P.S.I. 24.75
ELECTRIC ACTUATORS
Hundreds of uses for any mechanical device needing controlled 2 way action. Opens, closes, raises or lowers doors – windows – gates – valves.
CTU-2 – Foote Linear Actuator – 24 volt, DC, 8500 RPM, 1/6 HP – series wound motor. 4½" stroke in 13½ sec. Compression and tension loads up to 750 lbs. Adjustable micro switch for limits of travel. Overall lngth., retracted 11" 7.95
We also carry many more sizes and types of Actuators. Write today for information.
HYDRAULIC CYLINDERS
Gives 20,000 lb. thrust (push or pull) using 1500 PSI line pressure as obtained from our hydraulic pumps. Will produce up to 40,000 lbs. thrust with 3000 PSI. Can also be used on low pressure air systems. 4" bore; 18" stroke; 30½" length. Ideal for road farm – shop machinery. 29.75
No. 3 HYDRAULIC CYLINDER
Double action. Bore is 1" – Shaft ½". Has stroke of 2½" to 4". Stroke can be adjusted with internal sleeve stops. Overall length is 8½". will take 1500 lbs. continuous duty. 3000 lbs. intermittent. Will lift or push up to 1100 lbs. 5.75
We stock over 30,000 Hydraulic Cylinders, Valves, Pumps, Accumulators, Hand Pumps, Motors, Hose, etc. All at Money Saving Prices.
230 Pg. CATALOG
Amazing Values! 1000's of items for Mfgr., Mechanic, Sportsman, etc. Save on Machine Tools, Hydraulics, Pumps, Valves, Hand & Power Tools, Instruments, etc. Send for your copy today!
PALLEY SUPPLY CO.
2263 E. VERNON AVE.
Dept. AH-8
LOS ANGELES 58, CALIF.
Order from this ad. Pay by M.O. or check. P.O.'s accepted from O&B firms. ½ deposit with C.O.D.'s.
All Prices F.O.B. Los Angeles

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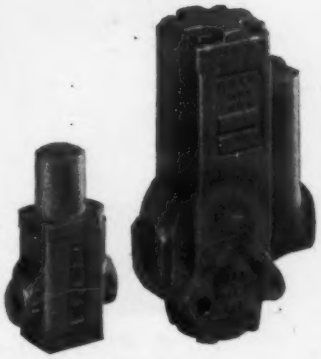
## Improve Your Handling Equipment with BHEW HYDRAULIC Flow Control Valves



Increase stability and safety of your lift and straddle trucks. BHEW Flow Control Valves *automatically* control load descent rate at predetermined speed, heavier the load the slower the lowering rate! Eliminate surge at start of descent. No restrictions on load lift speed or empty fork movement. Models for all size trucks, for attachment or O.E.M. applications. Write for detailed, illustrated literature.

### and Custom O.E.M. Cylinders

All types and sizes of standard and especially designed cylinders for tilts, hoists, clamps, shifters. Cylinders have small O.D., need minimum mounting clearance. Available for any mounting you desire. Have honed barrels, plated rods, non-adjustable glands. Send specifications of *your* application to

**BENTON HARBOR ENGINEERING WORKS**
**BENTON HARBOR, MICHIGAN**

**Send for literature today.**

# Post Scripts of Industry

**News about people, manufacturers and sales organizations**

*Norman A. Duffany*
*Precision Rubber Products Corporation*

*D. W. Hopkins*
*Hydraquip Corp.*

*Roderick D. MacDonald*
*The Weatherhead Company of Canada Ltd.*

**Norman A. Duffany** has been named manager of the Chicago office of **Precision Rubber Products Corporation.** Duffany came to Precision Rubber Products from the New York Air Brake Company, where he had 19 years experience in industrial, automotive and aircraft hydraulics. As manager of the Chicago office, he succeeds Harlan Davis.

**Hydraquip Corp.**, of Houston, Texas, distributors, designers and manufacturers of hydraulic and pneumatic equipment, announced the opening of sales offices at 3908 Lemmon Avenue, Dallas, and the appointment of **D. W. Hopkins** as sales engineer. Headquartering in the Dallas office, he will represent the company in the North Texas area.

**Roderick D. MacDonald** was named general sales manager of **The Weatherhead Company of Canada Ltd.**, St. Thomas, Ontario. MacDonald comes to the company with an impressive record of achievement in sales and administrative work. His most recent position was as assistant director of the aircraft division of the Canadian Department of Defense Production.

Announcement is made by **The Fulflo Specialties Co.**, Blanchester, Ohio, of the appointment of the following representatives: Lewis Pump Co., Philadelphia, Pa.; Truman E. Longley Co., Cleveland, Ohio; Pump Engineering Co., Los Angeles, Calif.; Wooden and Little, San Francisco, Calif.; Robert Taylor and Sons, Salt Lake City, Utah; Rogers and Baxter, St. Louis, Mo.; R. MacLeay and Co., Ltd., Montreal, Canada.

**Bernard Anscher** has been appointed sales manager for domestic sales of **Hydropress, Inc.**, New York and its Loewy Rolling Mill Division.

**Fred S. Shumaker,** long associated with the **Wayne Pump Company,** has been made a special representative and marketing consultant for the company in the New York region. The previous duties of Shumaker will be assumed by **Thomas E. McLaron** who will be New York regional manager. McLaron has been associated with the Wayne Pump Company and previously with Martin & Schwartz Inc. in the New York area.

**Harold Granger,** Eastern regional manager of **The Bellows Co.**, named four field engineers to service territories with the following headquarters. **Michael J. Vancheri,** 727 Penn Ave., Box 8793, Wilkinsburg 21, Pa.; **Thomas J. Garfield,** 69 Lincoln Park, Newark 2, N. J.; **William Hultgren,** 70 East 45th Street, New York 17, N. Y.; and **Daniel**

# No Single Hydraulic Oil Fits All Operating Conditions Economically

***That's why Sun makes a variety of oils to give top performance and economy in any system***

The selection of the right hydraulic oil is determined by many factors, such as average operating temperature; rate of leakage; contamination caused by cutting fluid, water and dirt. *No single oil will meet all combinations of conditions economically.* It's sensible, therefore, to choose a hydraulic oil with care . . . to be sure that it will give top performance at lowest possible cost. Consult your local Sun office or write SUN OIL COMPANY, Philadelphia 3, Pa., Department AH-8.

**INDUSTRIAL PRODUCTS DEPARTMENT**

**SUN OIL COMPANY**

SUNOCO®

PHILADELPHIA 3, PA. ◆ SUN OIL COMPANY LTD., TORONTO & MONTREAL

J. Rowan, 183 Hartford Avenue, Providence 9, R. I.

To provide the space needed for more stock, and to increase the size of assembly and shipping facilities, **Nielsen Hydraulic Equipment, Inc.**, has moved from Lafayette Street to 4 Penn Place, Pelham Manor 65, New York.

**Parker Aircraft Co.**, Los Angeles, subsidiary of The Parker Appliance Company of Cleveland, announced its acquisition of **Proof Industries'** complete line of aircraft hydraulic directional control valves along with Proof's order backlog on these products amounting to approximately one million dollars. The transaction included leasing of Proof's plant and facilities at 10000 Exposition Blvd., Los Angeles which will now operate as the Proof Division of the Parker Aircraft Co. By the transaction, Parker procured the services of aircraft hydraulics engineer **Henry Trich**, who will serve as manager of the new division.

**James J. Becher** was named a sales engineer in the Chicago district office of **General Dynamics Corporation's Electro Dynamic Motor and Generator Division**, Bayonne, New Jersey. **Douglas S. Birgfeld** has been appointed a sales engineer to the Philadelphia district office. His addition to the staff is part of an expanded sales and advertising program for the company under the direction of Dean W. Paul, sales manager. **Raymond E. Scheubel** has joined the Methods and Planning department of the company as a tool design specialist.

*Francis D. Skelley*
*Honan-Crane Corporation*

**Francis D. Skelley** has joined the **Honan-Crane Corporation** as sales engineer for the state of New Jersey. Skelley formerly served as sales manager of the **Standard Electronics Research Corp.** of New York. Headquarters in his new position will be Honan-Crane's warehouse in Ridgfield. **Thomas C. Tiearney**

How many times have YOU wished for a needle valve that would hold adjustment?
FLUID CONTROLS NEEDLE VALVES
HOLD ADJUSTMENT!
■ Easily adjusted
■ Leakproof
■ Long trouble-free life
Complete engineering data and specifications now available
• For Oil Or Gasoline • Copper-Brazed Steel Body • For 3000 P.S.I. 1/4", 3/8" and 1/2" Pipe Sizes
Fluid Controls, inc.
Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves • Needle Valves • Pilot Check Valves • Clamping Valves • Small Spring Loaded Accumulators • Special Valves
1284 N. CENTER STREET
MENTOR, OHIO

was promoted to the sales engineering staff and will service the Ford Motor Company accounts in Detroit, Chicago and Cleveland.

**Marion E. Burton** has been appointed director of advertising for **Denison Engineering Company.** He will direct trade journal and all other advertising activity for the company.

**Hydreco, a Division of the New York Air Brake Company,** has appointed 24 hydraulic equipment distributors in the U. S. and one in Canada to handle Hydreco products. The newly appointed distributors are located in Ohio, Pennsylvania, California, Illiñois, Indiana, Georgia, Maryland, Massachusetts, Minnesota, Missouri, New Jersey, New York, Texas, Utah, Wisconsin and Vancouver, B. C.

*Jack L. Modrich*
*Mechanical Air Controls, Inc.*

**Jack L. Modrich** became new general sales manager for **Mechanical Air Controls, Inc.** He was previously connected as sales manager with Miller Motor Company.

**Sherman W. Richardson** was appointed as industrial relations manager of **Oliver Iron and Steel Corporation.** Richardson will be responsible for personnel and industrial relations activities, including public relations programs. He has a broad experience in industrial relations problems, having been associated with several local leading manufacturing corporations.

**Parker Appliance Co.** announced the appointment of **Harry D. Stone** as industrial sales engineer for the northwestern Ohio territory. Stone will work out of the Cleveland district sales office.

**Hanscome-Rogness, Inc.,** 135 South Eleventh Street, Minneapolis 3, Minnesota announced the change of its name to **H. U. Rogness, Inc.** All company policies and personnel will remain the same.

The appointment of **Donald O. Wynocker** as the Toledo and northwestern Ohio representative of **J. N. Fauver Company, Inc.,** has been announced.

SUPERIOR NON-AGING
Hydraulic Tubing . . .

***100% Better Workability Than Ordinary Steel Tubing!***

**There's a reason, of course, why Superior's special, cold drawn, seamless hydraulic tubing is so much more ductile than common tubing . . . It is drawn from hollows made from aluminum-killed tube billets, under special melting practice. And carbon content is held to .12% maximum. (Did you realize that JIC Standards allow up to .18% maximum carbon content?)**

***Result:*—NON-AGING tubing of exceptionally low yield strength and unusually high elongation. The relatively thin walls and smaller outside diameters make it easy to form long sweep bends and eliminate many fittings—or bend to close radii in cramped spaces.**

**All Superior hydraulic tubing receives a 100% hydrostatic test before delivery and each order is tested for flareability. You may specify Superior tubing in any size from ⅛" to 1⅛" O.D. Our new folder gives sizes, wall thicknesses and recommended maximum working pressures. The coupon will bring you your copy.**

Superior
THE BIG NAME IN SMALL TUBING

**All analyses .010" to ⅝" O.D. Certain analyses (.035" max. wall) up to 1⅜" O.D.**

Superior Tube Company
2030 Germantown Ave., Norristown, Pa.

Please send me at once your newest folder on Superior Hydraulic Tubing.

Name.....
Title.....
Firm.....
Address.....
City.....State.....




Circle 99 on Reader Service Card

Continued

**Cooper Precision Products,** a Los Angeles manufacturer of quality hex-head bolts for the aircraft industry, will become a wholly owned subsidiary of the **Standard Pressed Steel Co.,** Jenkintown, Pa. This arrangement will permit SPS to further diversify its products and give it manufacturing facilities in the heart of the Pacific coast aircraft industry. Harry S. Cooper will remain as president of Cooper Precision Products.

The following officers were elected at a meeting of the board of directors at the general offices of the **Ajax Flexible Coupling Co., Inc.: William T. Welch,** president; **Wayne Belden,** executive vice-president; **Charles Belden,** vice-president; **H. E. Northrop,** treasurer and **Robert G. Cadt,** secretary.

**Rockwell Manufacturing Company** has set up a separate division in its plant, for the manufacture and sale of a new air-hydraulic drill unit. This is the first power tool manufacturing operation to be conducted by the company in its Pittsburgh facilities. The new division called the **Drill Unit Division,** is headed by **Ralph Caouette,** general manager of the firm's Register Division.

**George A. Strever**
**Roylyn, Inc.**

**H. H. Witte**
**Roylyn, Inc.**

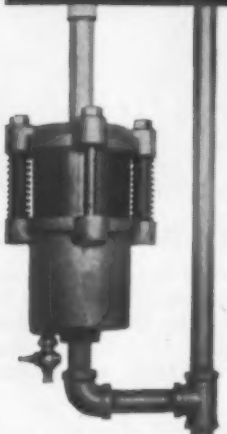
**Roylyn, Inc.,** named **H. H. Witte** and **George A. Strever** to newly created sales posts. These appointments are a part of Roylyn's overall expansion program to create closer coordination and greater service for industry. Witte was appointed district sales manager in Northern California and Strever was appointed division sales manager of the Western division, including the inter-mountain states.


3 Advantages are YOURS if you use . .

UNIVERSAL

(THE ORIGINAL)
POROUS STONE
AIR FILTERS
IN YOUR COMPRESSED AIR LINES

A MILLION PORES are present in a 4" diam. stone—used in a ¾" size unit.



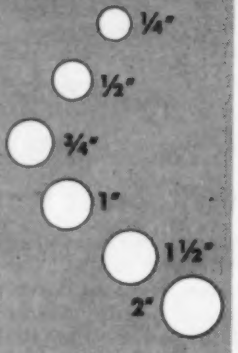
TWO STONES—2" in thickness but of varying diameters to fit different filter sizes—supplied with each Filter unit.

1 Employ centrifugal action to secure complete separation of the larger particles of oil and water from compressed air and a minutely porous synthetic stone to remove the final traces of condensed water and oil.

2 They actually FILTER the air through the innumerable zig-zag pores of the stone of the tiniest particles of extraneous matter.

3 They're the EASIEST Filters to maintain. Simply remove one cap screw and loosen the other three, without disturbing the piping, and remove the stone for cleaning in oil solvent. The stones last indefinitely. Maintenance reduced to a minimum.

MADE FOR 6 PIPE SIZES




they INSURE PURE, DRY, OIL-FREE COMPRESSED AIR

Designed so that flow of air is UPWARD through the filter stone. When air is shut off the pull of gravity aids in drawing condensation and oil down to lower chamber for escapage through drain, hence stones require less frequent changing. Universal Air Filters are applicable to every type of industry.

The ORIGINAL Porous Stone Air Filter

UNIVERSAL FILTER CO., INC.
7021 MANCHESTER • ST. LOUIS 17, MO.

Name .....
Address .....
City ..... State .....

SEND THIS COUPON TODAY for COMPLETE INFORMATION

Expansion of the Aviation Products Sales departments of **Pacific Airmotive Corporation** is well underway following the recent move to new plant facilities adjacent to PAC's home office. The 30,000 square foot site will house domestic and export sales offices, warehouse shipping and receiving.

**Greer Hydraulics, Inc.,** announced the appointment of **Compressed Air Products,** 1977 Springfield Ave., Maplewood, New Jersey, as agents for the sale of Greer products, except airborne and test stand applications, in the state of New Jersey north of Mercer, Middlesex and Monmouth counties.

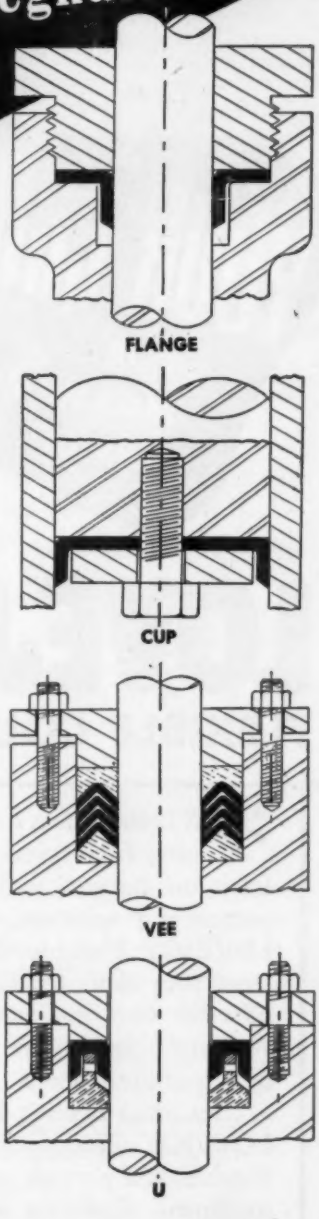
**Sealtite Corporation,** 1925 Washington Ave., St. Louis 3, Missouri, has been appointed distributor for O-rings manufactured by the **Parker Appliance Co.** The firm will have on call the services of **P. E. Walker,** Parker sales engineer for the St. Louis territory.

**Link-Belt Company** appointed **Harvey V. Eastling** assistant general manager of its Pacific Division, with headquarters at San Francisco and **Donald E. Thal** as sales manager of the San Francisco plant.

Appointment of **Chester M. Boehm** as manager of sales policy, mechanical goods division, **United States Rubber Company** was announced. Boehm, former assistant manager of the sales operating department, has been with the company since 1920.

**David S. Wyse,** former president of Gadgets, Inc., has been named president of the newly formed **Associated Technical Sales Company.** This company will provide service representation for manufacturers of hydraulic components and aircraft equipment. It has already been


Tannate®
LEATHER PACKINGS
are Custom Impregnated




The use of special impregnating materials is another phase in the "custom-manufacture" of Tannate leather packings. Depending upon the pressures encountered, Tannate packings are "custom impregnated" for operation against pressures ranging from a very few ounces up to many thousand pounds per square inch. Tannate packings (because of Rhoads exclusive processes) can be made rock-hard or very flexible in character, depending upon your requirements. *Tannate packings last longer, perform better, and ultimately cost less than ordinary packings.*

You get these advantages in Tannate Leather Packings: They have a low coefficient of friction; do not cold flow; will not score or abrade. They do not require lubrication, and they can be stored indefinitely without loss of tensile strength. Tannate packings are "custom-manufactured" to operate efficiently over a wide range of pressures and temperatures —from sub-zero to over 200° F.— and with different types of mediums.

Send us your packing requirements for quotation. Include type, service, pressure, temperature, dimensions and quantity. There's no obligation. Do it today.

*Write:*
J. E. RHOADS & SONS
35 N. Sixth St., Philadelphia 6, Pa.

RHOADS
INDUSTRIAL LEATHERS
PHILADELPHIA • NEW YORK • CHICAGO • ATLANTA

Continued

appointed to represent the Harley Buckle Division of the Sembodja Corporation and Gadgets, Inc.

**Barco Manufacturing Company,** Barrington, Ill., appointed the **Rawden Myers Agency,** Roselawn Center Building, Cincinnati 37, Ohio, as district representative for southern Ohio, southern Indiana and Kentucky.

**Greer Hydraulics, Inc.,** has added five sales engineers to its expanding staff. They are **Daniel E. Vasa, J. Edgar Myles, Raymond H. Collins, James R. Black Jr.** and **Geery B. Brown.** Vasa and Myles will be connected with Greer's Detroit office, Collins and Black will join the company's Chicago office and Brown will remain at the home office in Brooklyn.

Whether heavy-duty or light-duty, high-speed or low-speed, from oil burners and blowers to pumps and agitators, there is a LOVEJOY Flexible Coupling to meet your exact requirements. They offer the best obtainable insurance against alignment troubles —dampen and absorb starting torque, vibration and shock of intermittent loads . . . protect motor and driven machine . . . lengthen bearing life.

LOVEJOY Flexible Couplings are compact in construction, durable, and provide excellent resiliency. Bodies carefully machined. Cushions available in materials suited to the particular load conditions . . . can be changed without shutdown. No lubrication needed.

*Write today for illustrated catalog with handy selector charts.*

*Also Mfrs. of Lovejoy Universal Joints and Lovejoy Variable Speed Pulleys.*

**LOVEJOY FLEXIBLE COUPLING CO.**

5037 W. Lake St. • Chicago 44, Illinois


**Ronald G. Palmer** was appointed chief electronics engineer for **Tammen and Denison, Inc.,** industrial designers and consulting engineers of Chicago. He will be responsible for all electronic development, application and service operations in this field.

*Thomas A. Byrnes*
*Imperial Brass Mfg. Co.*

*Gordon J. Duerr*
*The Imperial Brass Mfg. Co.*

**The Imperial Brass Mfg. Co.,** Chicago, appointed **Thomas A. Byrnes** to the newly created position of sales manager, Eastern Division and **Gordon J. Duerr** to the newly created position of sales manager, Western and Midwestern Division.

The Detroit office of the **Garlock Packing Company** was moved in April to new and larger quarters at 2781 East Grand Blvd. At the same time the status of the Detroit office was changed from that of a subbranch reporting to Garlock's Cleveland office, to that of a regular district office reporting directly to the main office in Palmyra, N. Y. The Detroit district office will be under the di-

rection of **Edward M. Thomas, Jr.**

**Cartriseal Corporation** has moved to new, larger quarters at 3515 W. Touhy Ave., Lincolnwood, Illinois.

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### Rocky Mountain Industrial Exposition

"The Area—The Nation—The World" is the slogan adapted for the exposition sponsored by the Rocky Mountain Management Club, scheduled for the University of Denver's arena on September 10-12. The exposition is designed to offer manufacturers and distributors an opportunity to demonstrate the industrial importance of the region and to show their wares and services to prospective customers.

A highlighted innovation of the exposition will be a "by invitation only" showing between the hours of 2 and 6 pm on Thursday September 10. The exposition officially opens to the public at 6 pm on September 10 and runs till 11 pm, these same hours are in effect on September 11 and on Saturday September 12, the gates will open at 1 pm.

Inquiries should be directed to Harold S. Craig, Executive Secretary-Treasurer, Rocky Mountain Management Club, 1031 15th Street, Denver 2, Colorado.

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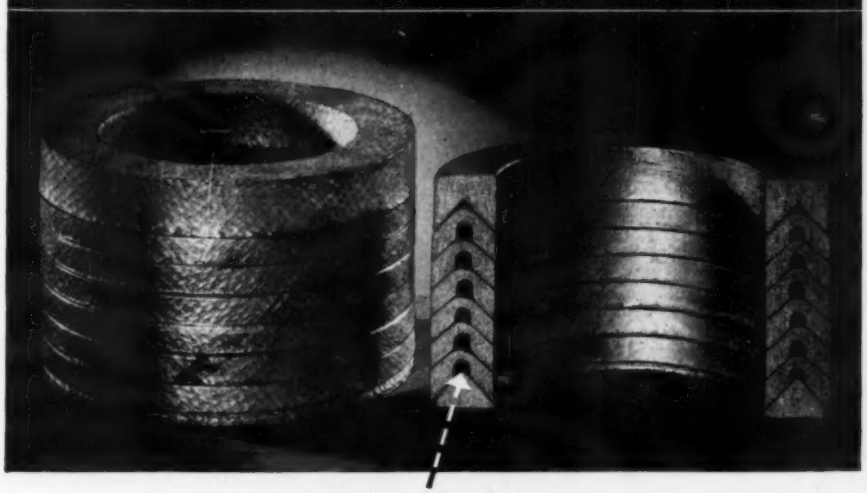
**Richard K. West,** president of Taco-West Corporation, announced change of his company's name to **West Instrument Corporation.** The West Instrument Corporation will continue to operate at its office and plant at 525 N. Noble Street, Chicago.

**Gadgets, Inc.,** has announced the appointment of **Associated Technical Sales Company** (ATSCO) as exclusive sales and service representatives for the United States. Already represented in Canada by **Genaire,**


# CHEVRON* PACKING



## Exclusive hinge-like construction assures a positive, low-friction seal

At every pressure—from the lowest to the highest—Garlock CHEVRON packing provides a positive, low-friction seal. CHEVRON is ideally suited for use on hydraulic cylinders (both single-acting and double-acting), hydraulic rams, plungers of pumps and other reciprocating rods.

The exclusive hinge at the apex of each ring makes this packing flexible and sensitive to pressure changes. When the pressure is on, CHEVRON packing seals firmly both on the inside and outside edges. When the pressure is off, CHEVRON packing maintains a positive seal yet allows the ram or rod to return without binding. This automatic action not only prolongs the life of the packing but also increases the efficiency of the equipment on which it operates.

That is why many manufacturers of hydraulic cylinders, jacks, lifts and presses use Garlock CHEVRON packing exclusively.

Whether your job is plant maintenance or manufacturing new equipment, ask us about CHEVRON packing—the exclusive product of Garlock's own factories. Garlock CHEVRON packing is available in many materials such as: cotton duck with rubber or neoprene binder, asbestos with rubber or neoprene binder, hycar, "Teflon," and "Kel-F."

THE GARLOCK PACKING COMPANY, PALMYRA, NEW YORK
In Canada: The Garlock Packing Company of Canada Ltd., Toronto, Ont.

*Branch Offices in Most Principal Cities*

*Registered Trademark

GARLOCK

PACKINGS, GASKETS, OIL SEALS,
MECHANICAL SEALS, RUBBER EXPANSION JOINTS

Ltd., this more recent appointment gives the company an opportunity to provide improved service on a nationwide basis. ATSCO offices are located in the Northtown Arcade Building, 4217 North Main Street, Dayton 5, Ohio, and Genaire, Ltd., at Municipal Airport, St. Catherines, Ontario, Canada.

A newly created post of director of manufacturing services of **Borg-Warner Corp.** will be occupied by **Frank W. Rickard,** previously general superintendent in charge of production at the Chrysler Corp. tank engine plant in New Orleans.

**Tube Reducing Corporation** of Wallington, N. J. has appointed **D. R. Strouse** as production manager. Strouse joined the company in January 1953 and served in an engineering capacity before this appointment. In his new duties he will take charge of receiving, planning, production and inventory control.

# THE MARKET PLACE

## CLASSIFIED ADVERTISING

**Classified Ad Rates**

Rate for "Positions Wanted" ads is $5.00 per column inch. For all other classifications, $20.00 for the first column inch and $15.00 for each additional inch.

### REPRESENTATIVES

Nationally known Pneumatic and Hydraulic Manufacturer seeks Manufacturer Representatives for a complete new line of Air and Hydraulic Cylinders: Exclusive territories: High Commissions. Reply giving full qualifications. All replies held confidential. Box 8153, APPLIED HYDRAULICS.

### SALES ENGINEER

To represent New England Factory Representative with complete line of Pneumatic and Hydraulic Equipment. Worcester and Springfield, Massachusetts vicinity. Please give resume of experience. Box 8253 APPLIED HYDRAULICS.

### SPECIALTY HOUSE

seeking to expand local sales operations, desires additional items. Will consider only HYDRAULIC and PNEUMATIC equipment, or components. Can act as a stocking distributor or exclusive agent in the State of Michigan. Must deal directly with principal. Hydraulic Accessories Co. 24301 Hoover Road, Van Dyke, (Detroit) Michigan.

### DESIGN ENGINEER

Modern, progressive, well reputed company in New York—outstandingly equipped for any precision machining—seeks association with mature engineer to design hydraulic valves, cylinders, etc. Lifetime opportunity for right party. Complete resume essential in first communication. Box 8353 APPLIED HYDRAULICS.

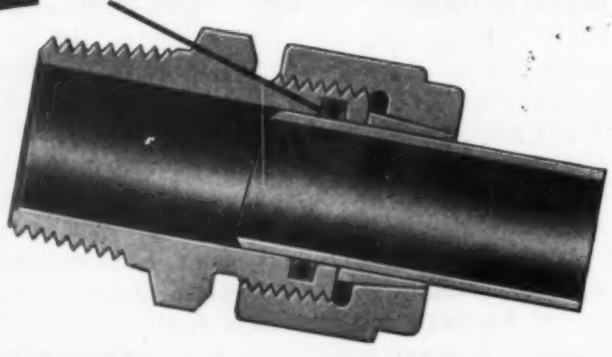
### REPRESENTATION FOR AIR & HYDRAULIC CYLINDER LINE

Lindberg Engineering Company, now expanding productive capacity of its Cylinder Division (for types of cylinders produced see last three ads in APPLIED HYDRAULICS) desires representation in industrial areas of following states: Illinois and Indiana (outside of Chicago area), Wisconsin, Minnesota, Nebraska, Kansas, Missouri, Oklahoma, Texas, Rocky Mountain States, Kentucky, Tennessee, Alabama, Georgia, Carolinas and Virginia. Inquiries will be welcomed from agents now selling allied pneumatic and hydraulic items or from those not satisfied with their present line. Please give sufficient information to make preliminary judgement of ability to promote and sell this type of equipment. Information on Lindberg's organization, cylinder experience and quality reputation, will be given to those not familiar with these details.

### DESIGN ENGINEER FOR AIR & HYDRAULIC CYLINDERS AND SYSTEMS

Expanding operations of Lindberg Engineering Company, Chicago, well established manufacturer of Air & Hydraulic Cylinders, creates an excellent opportunity for a young engineer, under 30. Prefer one to three years engineering experience in design and application of cylinders and control systems. Position can lead into sales responsibility if desired. Give complete resume of qualifications, salary range, family status, etc. LINDBERG ENGINEERING COMPANY, 2450 W. Hubbard Street, Chicago 12, Illinois.

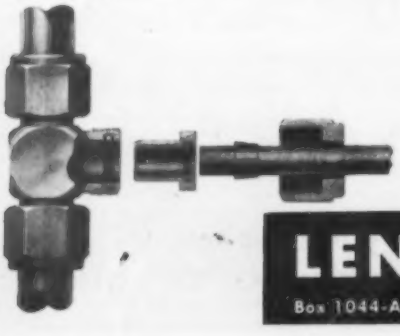

LENZ "O-RING" TUBE COUPLINGS



ELIMINATES
FLARING,
THREADING,
WELDING,
SOLDERING

A HACKSAW AND FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. Nut fits loosely on the tube for ease of assembly. The higher the pressure the tighter the grip. LENZ FITTINGS are ideal for quick, simple, easy to assemble, leak-proof connection — for steel or copper tubing — on air and hydraulic systems.



DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

LENZ COMPANY

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# Advertisers' Index

## August, 1953


A

Ace Products ..... 85
Acushnet Process Company ..... 103
Adel Division of General Metals Corp. 87
Aeroquip Corporation ..... Cover 2
Air Conversion Research Corp. ..... 98
American Crucible Products Co. ..... 97
American Engineering Co. ..... 27
Anchor Coupling Co., Inc. ..... 9
Automatic Switch Co. ..... 114
Automatic Valve Co. ..... 108

B

Barksdale Valves ..... 75
Bellows Co. ..... 32
Benton Harbor Engineering Works ..... 117
Berry Division, Oliver Iron & Steel Corp. ..... 4, 5
Brown & Sharpe Mfg. Co. ..... 20

C

CCA Products Div. Breco Mfg. Co. ..... 97
Capital Engineering & Mfg. Corp. ..... 98
Carlyle Rubber Co. ..... 117
Century Hydraulics ..... 116
Chain Belt Co. ..... 83
Chicago Rawhide Mfg. Co. ..... 45
Commercial Shearing & Stamping Co. 63
Conoflow Corporation ..... 117
Cuno Engineering Corp. ..... 33

D

Darcoid Co., Inc. ..... 127
Darling Valve & Mfg. Co. ..... 99
Davies Bros. ..... 109
Denison Engineering Co. ..... 40

E

Eastern Industries, Inc. ..... 29
Eastman Mfg. Co. ..... 65
Eastman Pacific Co. ..... 111
Electro Products Laboratories ..... 100

F

Flex-O-Tube Div. of Meridian Corp. ..... 34
Fluid Controls, Inc. ..... 120
Fuller Company ..... 10

G

Gadgets, Inc. ..... 128
Galland Henning Mfg. Co. ..... 111
Garlock Packing Co. ..... 125
Gast Mfg. Corp. ..... 81
General Controls Co. ..... 25
Gerotor May Corp. ..... 74
Greer Hydraulics, Inc. ..... 90, 91
Gre-Sen Manufacturing Co. ..... 113

H

Hanna Engineering Works ..... 1
Hannifin Corporation ..... 79
Harrison Radiator Div. General Motors Corp. ..... 28

I

Hilliard Corp. ..... 110
Hoke, Inc. ..... 16
E. F. Houghton & Co. ..... 41
C. B. Hunt & Son, Inc. ..... 76
Hydraulic Accessories Co. ..... 115
Hydro-Motor Div. The Bonnot Co. ..... 35

J

James-Pond-Clark ..... 85
Johns-Manville ..... 15

K

Keelavite Rotary Pumps & Motors Ltd. 14
Kobe, Inc. Div. Dresser Equipment Co. ..... 92
Kohler Co. ..... 8

L

L & L Mfg. Co. ..... 105
Lenz Co. ..... 126
Linear, Inc. ..... 78
Lindberg Engineering Co. ..... 70
Logan Engineering Co. ..... 109
Lovejoy Flexible Coupling Co. ..... 124

M

C. W. Marsh Corp. ..... 26
Jas. P. Marsh Corp. ..... 115
Marvel Engineering Co. ..... 18
M-B Products ..... 81
Miller Motor Co. ..... 67
Minnesota Rubber & Gasket Co. ..... 11
Monsanto Chemical Co. ..... 13



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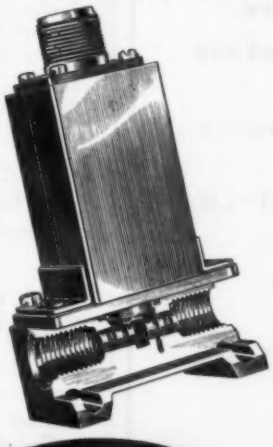

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## *Advertisers' Index*


**N**

Neptune Power Plus Products Co. ..... 105
Niagara Blower Co. ..... 12
W. H. Nicholson & Co. ..... 113

**O**

Oberdorfer Foundries Inc. ..... 80
Oilgear Co. ..... 3
Ortman-Miller Machine Co., Inc. ..... 100

**P**

Pacific Division Bendix Aviation Corp. ..... 21
Palley Supply Co. ..... 117
Parker Appliance Co. ..... 94, 95
Pathon Mfg. Co. ..... 81
Pesco Products Division Borg-Warner Corp. ..... 85
Plastic & Rubber Products Co. ..... 30
Precision Rubber Products Corp. ..... 7

**R**

Racine Hydraulics & Machinery, Inc. .. 73
Reliant Industries ..... 92
Resistoflex Corp. ..... 101
J. E. Rhoads & Sons ..... 123
Robertshaw-Fulton Controls Co. ..... 93
Geo. D. Roper Corp. ..... 44

**S**

A. Schrader's Son, Div. of Scovill Mfg. Co., Inc. ..... 69
Sealol Corp. ..... 42
Skinner Electric Valve Div. Skinner Chuck Co. ..... 105
Snap-Tite, Inc. ..... 43
Sperry Products, Inc. ..... 109
Sprague Engineering & Sales ..... 112
Standard Oil Co. (Ind.) ..... 23
Standard Pressed Steel Co. ..... 109
Sun Oil Co. ..... 119
Sundstrand Machine Tool Co. Hydraulic Div. ..... 77
Superior Tube Co. ..... 121

**T**

Texas Company ..... 46
Tidewater Associated Oil Co. ..... 17
Towler Bros. (Patents) Ltd. Electraulic Works ..... 22
Albert Trostel & Sons Co. ..... 89
Turchan Follower Machine Co. ..... 37
Tuthill Pump Co. ..... 102

**U**

U. S. Gasket Co. ..... 38
U. S. Rubber Co. ..... 36
Universal Filter Co. ..... 122

**V**

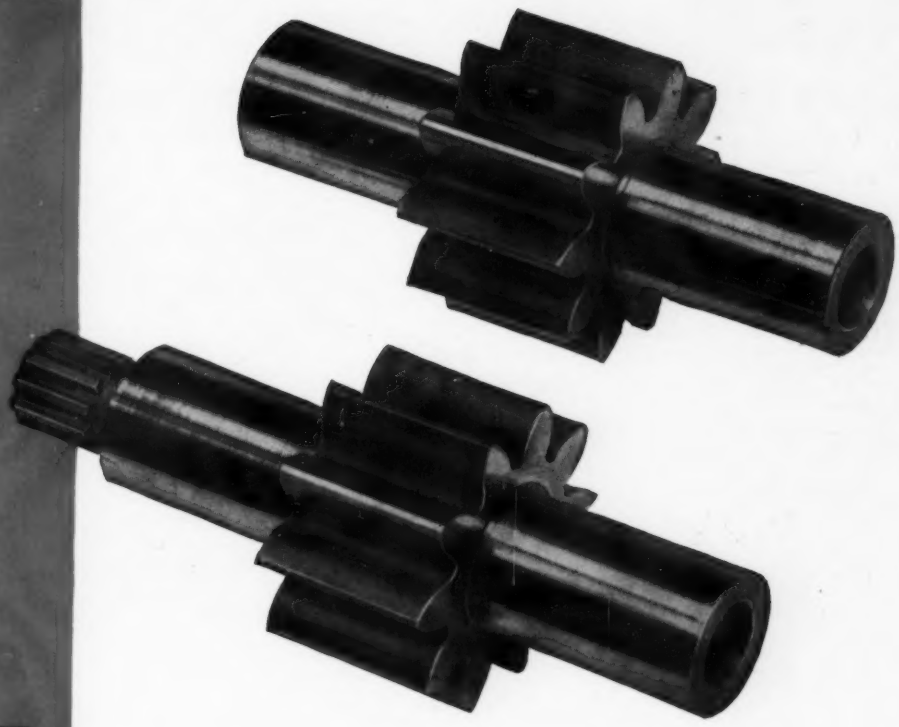
Valcor Engineering Corp. ..... 127
Valvair Corp. ..... 95
Vickers, Inc. ..... 31

**W**

Warner Div. of Detroit Harvester Co. of N. Y., Inc. ..... 96
Waterman Engineering Co. ..... 112
Weatherhead Company ..... 39
Webster Electric Co., Oil Hydraulic Div. ..... 107

**Y**

Yarnall-Waring Co. ..... 113



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**This SIMPLICITY OF DESIGN is important for these reasons!**

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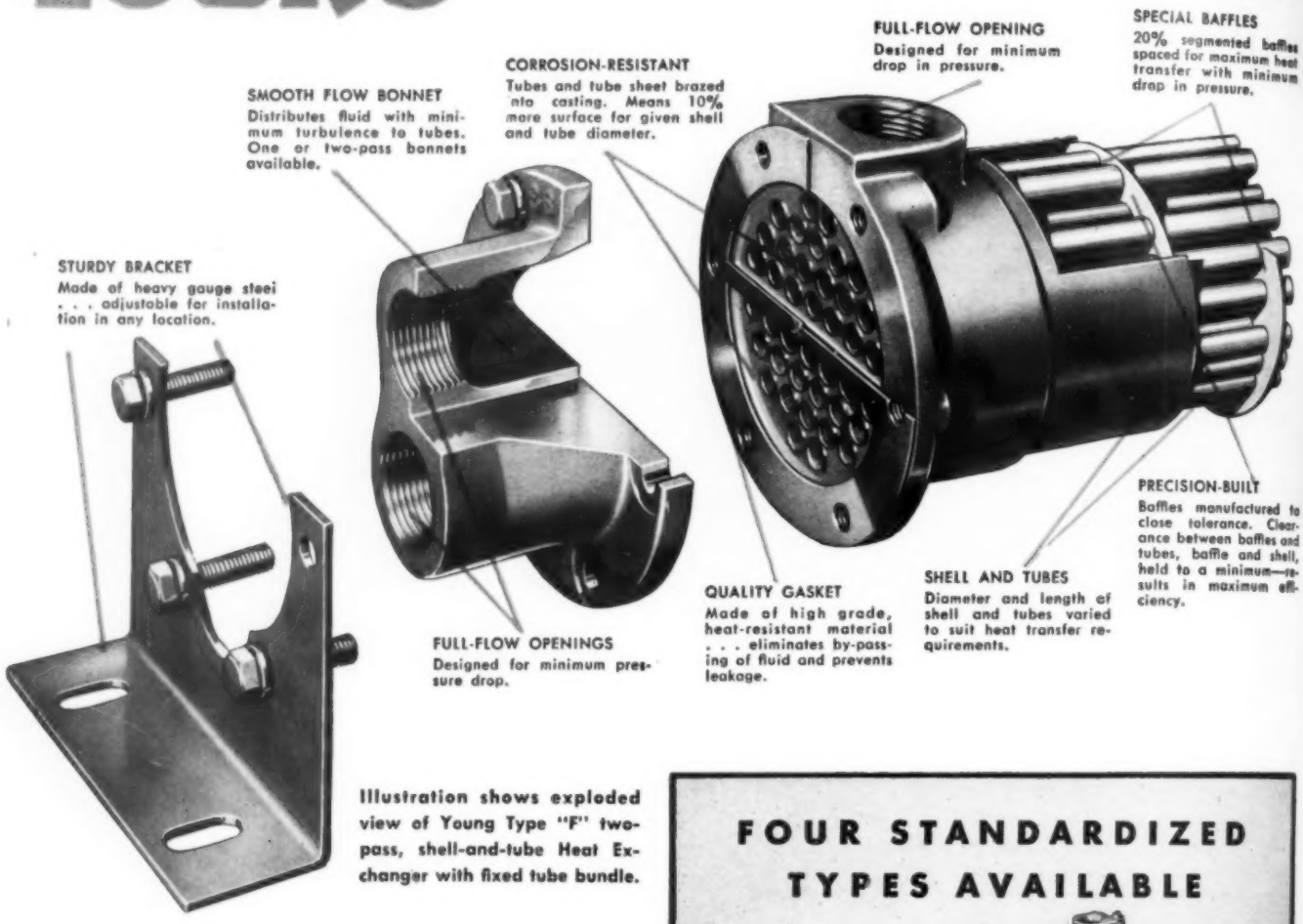
SMOOTH FLOW BONNET
Distributes fluid with minimum turbulence to tubes. One or two-pass bonnets available.
CORROSION-RESISTANT
Tubes and tube sheet brazed into casting. Means 10% more surface for given shell and tube diameter.
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SPECIAL BAFFLES
20% segmented baffles spaced for maximum heat transfer with minimum drop in pressure.
STURDY BRACKET
Made of heavy gauge steel . . . adjustable for installation in any location.
PRECISION-BUILT
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Diameter and length of shell and tubes varied to suit heat transfer requirements.
QUALITY GASKET
Made of high grade, heat-resistant material . . . eliminates by-passing of fluid and prevents leakage.
FULL-FLOW OPENINGS
Designed for minimum pressure drop.

Illustration shows exploded view of Young Type "F" two-pass, shell-and-tube Heat Exchanger with fixed tube bundle.

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Young standardized Heat Exchangers, recognized for their compactness in design, provide maximum heat transfer per unit volume of available space with minimum weight. They are used for any kind of fluid to fluid cooling. Single or multi-pass units—fixed tube bundle Type "F" and removable tube bundle Type "R"—are available in ferrous and non-ferrous metals and complete range of sizes. Type "F" units are shipped from stock, and Type "R" units are available for quick delivery. Write for catalogs 1049 and 1149.

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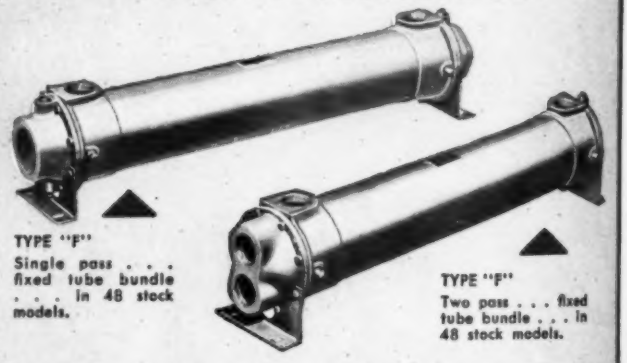

TYPE "F"
Single pass . . . fixed tube bundle . . . in 48 stock models.

TYPE "F"
Two pass . . . fixed tube bundle . . . in 48 stock models.

TYPE "R"
Single pass . . . removable tube bundle . . . in 258 standardized models.

TYPE "R"
Two pass . . . removable tube bundle . . . in 258 standardized models.

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